Section 6

REPLACEABLE PARTS AND REPAIR

This section contains the Replaceable Parts List *(Table 6-1)* for all parts and subassemblies that are replaceable within the scope of this manual. In addition, replacement procedures are provided for all parts listed in *Table 6-1*.

6.1 REPLACEABLE PARTS LIST

The replaceable parts required for the authorized repairs specified in this manual are listed below:

Table 6-1. Replaceable Parts List

Part Name
Adhesive, Black Max, (Loctite)
Assembly, cable, MCU/Display
Assembly, cable, MCU/Sensor
Assembly, handle, door opener
Assembly, mechanism
Assembly, pole clamp knob/screw
Backing plate, pole clamp
Battery pack
Bumper, mechanism (2)
Bushing, strain relief, black nylon
Cable clip, adhesive backed
Chassis, main
Cordset, AC power, hospital grade
Cover, door

Table 6-1. Replaceable Parts List
Part Name
Detent disk, knob
Door, battery
Door, front
Extrusion, pole clamp
Gasket, front cover
Gasket, front handle
Gasket, knob
Insulator, adhesive backed, pole clamp
Knob, front panel control
Label, front cover
Magnet (3)
Pad, battery door
Pad, battery support
Pad, foot (4)
PWA, Display
PWA, MCU
PWA, Power Supply

Table 6-1. Replaceable Parts List
Part Name
Shield, mechanism
Snap retainer, knob
Tip insert, pole clamp
Washer, knob

6.2 REPAIR AND REPLACEMENT PROCEDURES

Removal and replacement of parts are limited to those items listed in *Table 6-1, Replaceable Parts List.* Refer to *Figure 6-1, Flexiflo Quantum Enteral Pump, Panel Views*, for an overview of external replaceable parts. See *Figure 7-1, Exploded View of Flexiflo Quantum Enteral Pump* for a detailed view of replaceable parts.

WARNING

DISCONNECT THE PUMP FROM AC POWER AND DISCONNECT BATTERY BEFORE PERFORMING ANY DISASSEMBLY AND REPAIR PROCEDURES.

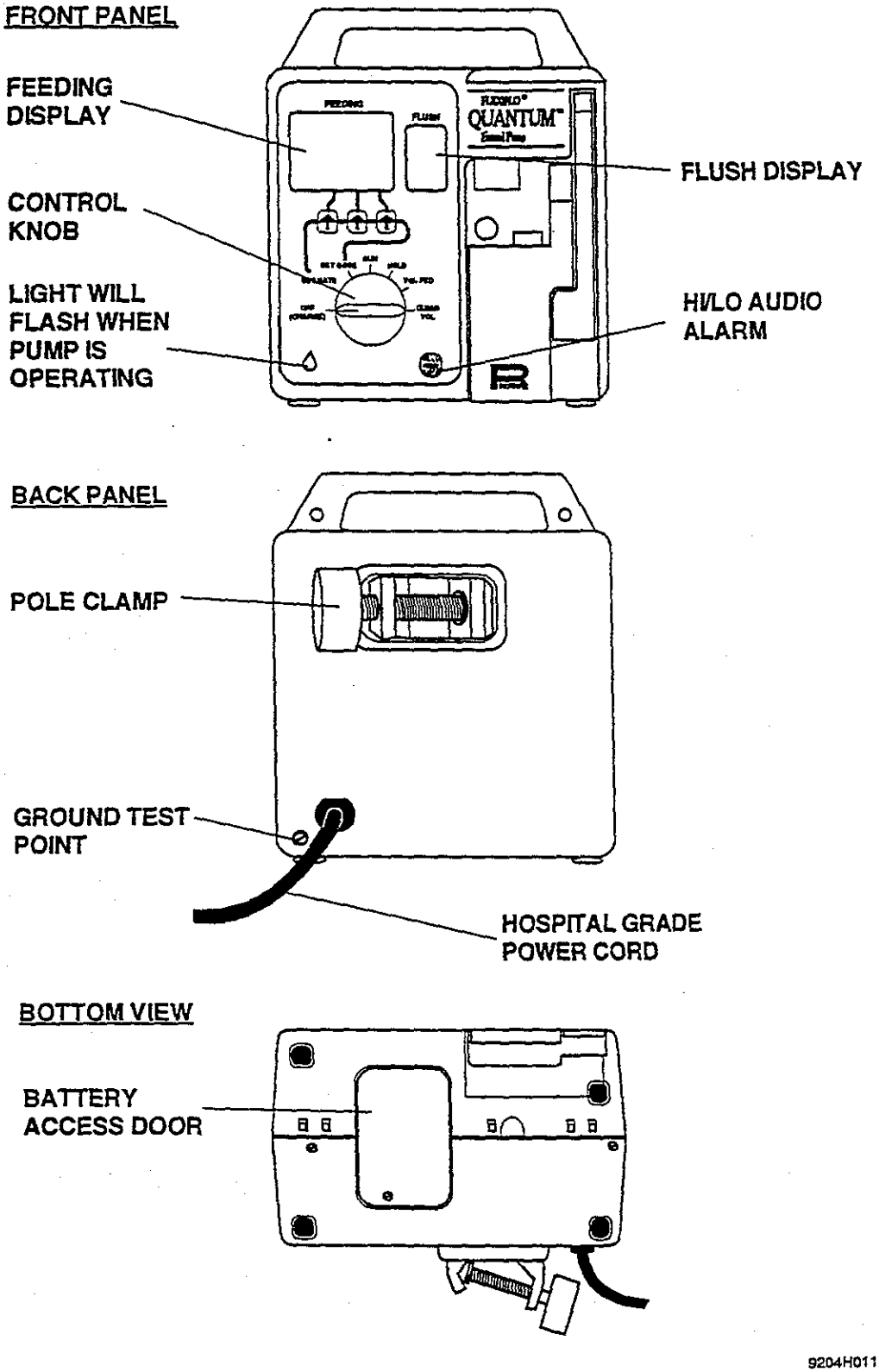


Figure 6-1. Flexiflo Quantum Enteral Pump, Panel Views

6.2.1

REQUIRED TOOLS AND MATERIALS

The standard hand tools and materials required for repair and replacement procedures follow. Tools and materials required for a specific procedure are listed at the beginning of the procedure.

6.2.1.1

STANDARD HAND TOOLS

Standard hand tools required for the repair and replacement procedures are as follows:

- ❑ Set of nutdrivers
- ❑ Medium size flat blade screwdriver
- ❑ Small-size flat blade screwdriver
- ❑ Wood chisel, 3/8 inch
- ❑ X-acto® knife (square, round, and pointed blades)
- ❑ Electronics-grade needle-nose pliers with serrated tip
- ❑ Electronics-grade wire cutters
- ❑ Wire strippers
- ❑ Electrician's knife
- ❑ Wide head pliers
- ❑ Electronic wire terminal crimper, 14 - 16 AWG

6.2.1.2

SPECIAL TOOLS

Additionally, an installation tool for the strain relief bushing is required for certain repair and replacement procedures.

6.2.1.3

MATERIALS

Materials required for certain procedures are as follows:

- ❑ Loctite®, Black Max adhesive
- ❑ Plastic or aluminum rod, one inch diameter and two inches in length

6.2.2

BATTERY DOOR, BATTERY DOOR PAD, AND BATTERY PACK REPLACEMENT

These procedures require a 1/4 inch nutdriver or a standard flat blade screwdriver, X-acto knife with round blade, and mild solvent.

To remove and replace the battery door, door pad, and battery pack, proceed as follows:

1. Turn control knob to OFF (CHARGE) and confirm pump is disconnected from AC power. Lay pump on its side, on a clean cloth or soft work surface, with bottom of pump facing the technician.
2. Using a 1/4 inch nutdriver or medium flat blade screwdriver, remove the 6-32 hex head screw from the battery door. Remove the battery door and set the screw and door aside.
3. Remove defective pad material from battery door, using an X-acto knife and a mild solvent. Dry door thoroughly.
4. Place a new adhesive-backed pad between the grooves on the battery door and against the raised dog-leg.
5. To remove and replace the battery pack, pull the wires and male/female connectors outside the battery pack enclosure. Disconnect both connectors and remove the defective battery pack from the pump.
6. Replace battery pack only with a Ross-approved battery.
7. Slide new battery pack into the pump with wire leads and connector remaining outside the case. Reconnect male plug to the female connector.

   Note: The connectors are keyed in only one direction.

8. Do not replace the battery door. Carefully set the pump upright. Open the cassette door assembly, install a cassette, and close the door.
9. Turn the control knob to SET RATE and confirm the pump performs a self-test. The pump beeps and displays a flashing PRIMING and SET RATE on the LCD screen. Turn the control knob to OFF (CHARGE).
10. Return pump to its side, and tuck battery wires and connectors into battery pack recess. Confirm wires are not pinched, kinked, or chaffed.
11. Assemble battery door and pad to the pump and secure, using the 6-32 hex head screw previously removed.
12. Perform the Performance Verification Test (PVT) as described in *Section* 4.2.

6.2.3

POLE CLAMP KNOB/SCREW ASSEMBLY AND TIP INSERT REPLACEMENT

This procedure requires a solid one inch diameter plastic or aluminum rod, and a pair of wide head pliers.

The pole clamp assembly consists of four items: the pole clamp knob/screw assembly, black tip insert, extrusion, and backing plate. Only the pole clamp knob/screw assembly and black tip insert are field serviceable without opening the front and rear enclosure assemblies of the pump. Refer to *Section 6.2.10.9, Pole Clamp Extrusion and Backing Plate Replacement*, for removal and replacement of the pole clamp extrusion and backing plate.

To remove and replace the pole clamp knob/screw assembly, and tip insert, proceed as follows:

1. Turn the control knob to OFF (CHARGE) and confirm pump is disconnected from AC power.

2. Turn the pole clamp knob counterclockwise, until it is removed from the pole clamp extrusion, which loosens the insert.

   Note: The insert has a long shank that is pressed into the threaded knob/screw assembly. Turn the threaded assembly clockwise back into the extrusion, in order to grasp the insert shank with a pair of wide head pliers.

3. Turn the pole clamp knob/screw assembly counterclockwise, holding the insert shank loosely with the pliers. The insert is removed from the threaded screw assembly. The pole clamp knob/screw assembly may now be removed.

   Note: If the tip insert is in good condition, it may be reused with a new screw/knob assembly. If defective, the tip insert must be replaced.

4. Reassemble by turning the pole clamp knob/screw assembly clockwise, into the extrusion, until the threaded portion (with hole recess) is visible. Press a new black tip insert into the screw hole recess.
5. Place a solid, one inch diameter plastic or aluminum rod in the extrusion cradle, opposite the insert. Turn the pole clamp knob/screw assembly (with black insert), clockwise until the insert is secure against the rod and cannot be further turned.
6. Place the pump on an IV pole stand and secure the pole clamp knob/screw assembly to the pole. Confirm the pump does not slide on the IV pole.
7. If the pump may have been damaged during this procedure, perform the Performance Verification Test (PVT) as described in *Section 4.2*.

6.2.4
AC POWER CORD PLUG AND VELCRO STRAP REPLACEMENT

This procedure requires an electrician's knife, wire cutters, and wire strippers.

Obtain a green-dot, hospital grade replacement for the damaged AC power cord plug. The defective plug may be replaced without replacing the entire cord. The exact procedure for replacing the AC power cord plug depends upon the construction of the replacement plug. The following procedure, therefore, is intended only as a guide and not as a specific method for plug replacement.

To remove and replace the AC power cord plug and the Velcro strap, proceed as follows:

1. Turn control knob to OFF (CHARGE) and confirm pump is disconnected from AC power. Remove the defective AC power cord plug by cutting the cord near the plug.
2. If the Velcro strap is defective, replace it prior to connecting the new plug to the AC power cord. Remove the defective Velcro strap from the AC power cord. Slide a new Velcro strap over the AC power cord.
3. To access the AC power cord plug terminals, disassemble the replacement plug.
4. Remove a sufficient amount of outer insulation from the end of the power cord for connection to the replacement plug. Remove approximately 1/4 inch of insulation from each of the three cable wires.

   Note: Two AC wires are black and white, and the ground wire is green.

5. Connect the three exposed wires on the AC power cord to the respective terminals in the replacement plug. Confirm that the green ground wire is connected to the ground lug on the AC power cord plug.
6. Reassemble the replacement plug.
7. Plug the AC power cord into an AC power source. Turn the control knob from OFF (CHARGE) to SET RATE position, and confirm the pump performs the self-test.
8. Perform the Performance Verification Test (PVT) as described in *Section* 4.2.

6.2.5
RUBBER FOOT PAD REPLACEMENT

This procedure requires a 3/8 inch wood chisel or an X-acto knife with a square blade, and Loctite Black Max adhesive.

To remove and replace the rubber foot pads, proceed as follows:

1. Turn control knob to OFF (CHARGE) and confirm pump is disconnected from AC power.
2. Lay pump on its side, on a clean cloth or soft work surface, with bottom of pump facing the technician.
3. Using a 3/8 inch wood chisel or an X-acto knife with square blade, carefully cut away the defective foot pad.

   Note: Each foot pad is adhesive bonded in the enclosure recess. Do not damage the foot pad enclosure recess.

4. Carefully scrape the enclosure recess to remove rubber and adhesive residue. Clean excess residue with a mild solvent.
5. Replace the defective foot pad with a new foot pad. Using a small amount of adhesive, bond the new foot pad in the recess. Clean the area of excess adhesive. Confirm each foot pad is secure.
6. The PVT is normally not required for this procedure. However, if the pump may have been damaged during this procedure, perform the Performance Verification Test (PVT) as described in *Section* 4.2.

6.2.6
CASSETTE DOOR SUBASSEMBLY AND COVER REPLACEMENT

This procedure requires a small flat blade screwdriver.

To remove and replace the cassette door subassembly and cover, proceed as follows:

1. Turn control knob to OFF (CHARGE) and confirm pump is disconnected from AC power. Set pump on a clean cloth or soft work surface with the front facing the technician.
2. Lift the cassette door handle. To disengage the door roller, press the metal retainer plate on the door handle to the right. Pull the door assembly down.
3. Lift the door assembly slightly and pull away from the pump.

Note: The door assembly consists of the molded cover and door. The molded door contains a roller, cassette guide spring, and cassette load spring. The door subassembly is replaced as a unit.

4. The molded cover and door are assembled with a slight force/snap fit. Grasp the cover with one hand; using a small flat blade screwdriver, push the protruding cover retainer clip free from the cassette guide spring. Lift the door from the cover.
5. Assemble the cover and door subassembly by placing the roller arm into the cover. Snap the door subassembly into the cover.
6. Re-install the door assembly. Insert the door assembly into the recess over the pivot bars at the bottom of the pump mechanism. Pivot the door assembly until it seats. Pivot the door assembly upward, while pushing the metal spring retainer on the door handle to the right. The roller moves past the spring retainer edge. Close the handle that secures the cassette door assembly.
7. Place a cassette into the cassette door assembly. Close the cassette door. Confirm the cassette door opens and closes in a normal operating manner.

   Note: If the cassette door does not open and close in a normal operating manner, repeat Steps 2 through 7.

8. Plug the pump into an AC power source. Turn control knob to SET RATE, and confirm the pump performs the self-test. The pump beeps and displays a flashing PRIMING and SET RATE legend on the LCD screen. Turn the control knob to OFF (CHARGE).
9. Perform the Performance Verification Test (PVT) as described ~~in Section~~ 4.2.

6.2.7
SEPARATING FRONT AND REAR ENCLOSURE ASSEMBLIES

This procedure requires a 1/4 inch nutdriver or medium flat blade screwdriver.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To separate the front and rear enclosure assemblies, proceed as follows:

1. Turn pump to OFF (CHARGE) and confirm pump is disconnected from AC power. Set pump on a clean cloth or soft work surface.
2. Disconnect battery door and battery pack as described in *Section 6.2.2, Battery Door, Battery Door Pad, and Battery Pack Replacement.*
3. Using a 1/4 inch nutdriver or medium flat blade screwdriver, remove the two 6-32 x 1/2 inch hex head screws from the carrying handle area. Set the screws aside for reassembly.
4. Turn the pump so that the front faces the technician. Pivot the front enclosure assembly down and to the left. Disconnect P3 from J3 on the MCU PWA. Separate the front and rear enclosure assemblies.

6.2.8

FRONT OR REAR ENCLOSURE REPLACEMENT

This procedure requires a 1/4 inch nutdriver or a medium flat blade screwdriver, and an X-acto knife with a round blade.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove and replace the front or rear enclosure assemblies, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7*.
2. Remove the subassembly components. Refer to the specific procedure under *Section 6.2.9, Front Enclosure Assembly*, or *Section 6.2.10, Rear Enclosure Assembly*.
3. Replace the damaged front or rear enclosure assemblies with the new enclosure.
4. Reassemble the subassembly components. Refer to the specific procedure under *Section 6.2.9, Front Enclosure Assembly*, or *Section 6.2.10, Rear Enclosure Assembly*.
5. Reassemble the front enclosure assembly to the rear enclosure assembly. Pivot the keyed protrusions into the front enclosure assembly openings. Secure the assemblies with the two 6-32 x 1/2 inch hex head screws previously removed.
6. Reconnect battery door and battery pack as described in *Section 6.2.2*.
7. Confirm successful reassembly by connecting pump to an AC power source.
8. Open the door assembly, install a cassette in the door cassette holder. Close the door, turn control knob to SET RATE, and confirm the pump performs the self-test. The pump beeps and displays a flashing PRIMING and SET RATE legend on the LCD screen. Turn the control knob to OFF (CHARGE).
9. If the self-test does not occur, repeat Steps 1 through 5. Confirm that wires and cables are properly connected, and that no damage has occurred during reassembly.
10. Perform the Performance Verification Test (PVT) as described in *Section 4.2*.

6.2.9

FRONT ENCLOSURE ASSEMBLY

The front enclosure assembly includes the following parts that may be removed and replaced separately:

- ❑ Front enclosure
- ❑ Front cover label (adhesive backed)
- ❑ Gaskets (2), enclosure and handle
- ❑ Display PWA
- ❑ Display\MCU cable assembly
- ❑ Keys, molded, switch activated (4)
- ❑ Control knob kit: control knob; snap retainer (keeper); knob gasket; knob washer

- ❑ Detent disk (includes magnet)

Note: The control knob kit consists of control knob; snap retainer (keeper); gasket; and washer. This kit should be replaced as a single unit.

Specific component disassembly and replacement procedures follow.

6.2.9.1

FRONT COVER LABEL REPLACEMENT

This procedure requires an X-acto knife with round blade, and a mild solvent.

To remove and replace the front cover label, proceed as follows:

1. Confirm pump is disconnected from AC power. Remove the front cover label using an X-acto knife with a round blade. Remove excess adhesive residue using a soft cloth dampened with a mild solvent. Dry the label area thoroughly.

   Note: Do not damage the front enclosure during label removal and replacement.

2. Center the new, adhesive-backed label on the front enclosure recess. Smooth the label so that no air bubbles are present.

6.2.9.2

GASKET REPLACEMENT

This procedure requires a 1/4 inch nutdriver or standard flat blade screwdriver, and an X-acto knife with a pointed blade.

To remove and replace enclosure gaskets, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7*.
2. Use an X-acto knife to remove the gaskets from their troughs.
3. Press new gaskets in place. Press down on the gaskets while routing around the troughs.

   Note: The ends of the handle gasket must butt together in order to form an adequate seal.

4. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8*.
5. Perform the Performance Verification Test as described in *Section 4.2*.

6.2.9.3

DISPLAY PWA REPLACEMENT

This procedure requires a 1/4 inch nutdriver or medium flat blade screwdriver, and needle nose pliers.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove and replace the Display PWA, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Set the rear assembly enclosure aside. Lay the front enclosure assembly face down on a soft surface.
3. Using needle nose pliers or fingers, spread the two snap retainers nearest the display/MCU cable. Hold the retainers apart and lift up gently on the display/MCU cable assembly to free it from the retainers.
4. Repeat Step 3 for the two snap retainers near the door opening.
5. Remove the Display PWA from the front enclosure.
6. Reassemble the Display PWA and cable assembly into the front enclosure. Guide the PWA into the three "V" slots at the handle end of the front enclosure. Position the Display PWA over the four snap retainer posts and press in place.
7. Reassemble front and rear enclosure assemblies as described in *Section 6.2.8.*
8. Perform the Performance Verification Test as described in *Section 4.2.*

6.2.9.4

DISPLAY/MCU CABLE ASSEMBLY REPLACEMENT

This procedure requires no tools.

To remove and replace the display/MCU cable assembly, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. With the Display PWA removed from the front enclosure as described in *Section 6.2.9.3,* disconnect the display/MCU cable assembly from the J2 header on the Display PWA.
3. Replace the defective display/MCU cable assembly with a new assembly.
4. Reconnect the display/MCU cable assembly (colored stripe to pin number 1 on the J2 header) to Display PWA.
5. Reassemble front and rear enclosure assemblies as described in *Section 6.2.8.*
6. Perform the Performance Verification Test as described in *Section 4.2.*

6.2.9.5

MOLDED KEYS REPLACEMENT

This procedure requires no tools.

To remove and replace the molded keys, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Remove the Display PWA from the front enclosure as described in *Section 6.2.9.3.*
3. Remove the keys. Replace the keys in the three arrow key recesses, and in the single audio HI/LO recess.
4. Replace the Display PWA as described in *Section 6.2.9.3.*

5. Reassemble front and rear enclosure assemblies as described in *Section 6.2.8.*
6. Perform the Performance Verification Test as described in *Section 4.2.*

6.2.9.6

CONTROL KNOB KIT, DETENT DISK, AND MAGNET REPLACEMENT

This procedure requires a 1/4 inch nutdriver or a medium flat blade screwdriver, wide head pliers, and needle nose pliers.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

Note: The control knob kit consists of control knob; snap retainer (keeper); gasket; and washer. This kit should be replaced as a single unit.

To remove and replace the control knob kit, detent disk, and magnet, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section* 6.2.7. Set the rear enclosure assembly aside for reassembly.
2. Remove the subassembly components. Refer to the specific procedure under *Section 6.2.9, Front Enclosure Assembly.*
3. Using a pair of wide head pliers, grasp the center of the snap retainer (keeper). Pull the snap retainer out of the control knob.

   Note: The snap retainer is easily damaged. Use caution during snap retainer removal.

4. Using a pair of needle nose pliers, move the two angled retainer clips towards each other. The control knob, detent disk and magnet, gasket, and washer are released from the front enclosure. Remove all parts. Set the detent disk and magnet aside for reassembly.
5. Replace the defective parts with a new control knob kit. Assemble the kit as follows: Install the washer on the control knob. Place the sponge foam gasket on the washer's outer diameter. Place the control knob, washer, and gasket through the hole in the front enclosure.
6. Turn the control knob to CLEAR VOL.

   Note: When the control knob is at CLEAR VOL, the snap retainer and angled retainer clips are vertical.

7. Place the front enclosure face down on a soft work surface.
8. Place the detent disk (with magnet and six hemispherical balls face down) on the angled retainer clips and splines. (*Refer to Figure 6-2, Detent Disk Placement.*) Confirm the one quarter extended span of the detent disk is positioned to the top and right of the angled retainer clips. Press the detent disk down; it is secured by the angled retainer clips.

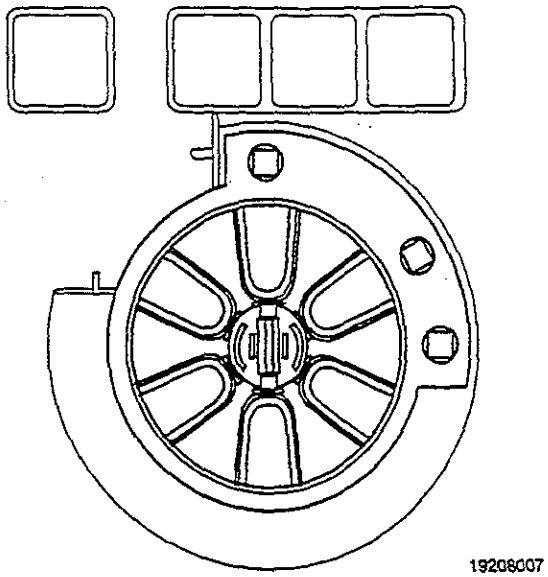


Figure 6-2. Detent Disk Placement

9. Confirm the detent disk is properly positioned. Turn the control knob to OFF (CHARGE). Rotate the control knob clockwise through all positions to CLEAR VOL. Confirm the disk detents at each position.
10. Install a snap retainer (keeper) between the angled retainer clips. Press firmly until the snap retainer is secured.
11. Place the four keys in position as described in *Section 6.2.9.5.*
12. Reassemble the Display PWA and cable assembly into the front enclosure. Guide the PWA into the three "V" slots at the handle end of the front enclosure. Position the Display PWA over the four snap retainer posts and press in place.
13. Reassemble front and rear enclosure assemblies as described in *Section 6.2.8.*
14. Perform the Performance Verification Test, as described in *Section 4.2.*

6.2.10
REAR ENCLOSURE ASSEMBLY

The rear enclosure assembly consists of the main chassis assembly and the rear enclosure assembly, their components, and subassemblies as follows:

- ❑ Main chassis assembly
  - Main chassis (includes battery support pad and 2 cable clips)
  - MCU PWA
  - Mechanism assembly
  - Sensor/MCU cable assembly
  - Shield and gasket
  - Bumpers (2)
  - Door opener handle kit: door opener handle; spring, door limit/retainer; retaining ring, E-Type, .188 ID; door roller
- ❑ Rear enclosure assembly
  - Rear enclosure

- Power Supply PWA
- Insulator
- Extrusion, pole clamp, and backing plate
- AC power cord and bushing, strain relief, black nylon

Note: On certain serial number units, clips are molded into the main chassis.

Note: The door opener handle kit consists of: door opener handle; spring, door limit/retainer; retaining ring, E-Type, .188 ID; and door roller. This kit should be replaced as a single unit.

Specific component disassembly and replacement procedures follow.

6.2.10.1

MCU PWA REPLACEMENT

This procedure requires a 1/4 inch nutdriver or medium flat blade screwdriver.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove and replace the MCU PWA, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Disconnect harness connectors P7, P8, P9, and P5 from the MCU PWA.
3. Remove the MCU PWA from the main chassis.
4. Slide the replacement MCU PWA into the guides on the left side of the main chassis.

   Note: Ensure that connector P4 mates fully with J4 on the Power Supply PWA.

5. Reconnect P7, P8, P9, and P5 harness connectors to the MCU PWA.

   Note: Confirm that there is no binding or pinching of harnesses or cables during reassembly.

6. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8.*
7. Perform the Performance Verification Test, as described in *Section 4.2.*

6.2.10.2

SEPARATING MAIN CHASSIS ASSEMBLY FROM REAR ENCLOSURE

This procedure requires a 1/4 inch nutdriver, small and medium flat blade screwdrivers, and an X-acto knife.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To separate the main chassis assembly from the rear enclosure, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7*. Set the front enclosure assembly aside for reassembly.
2. Disconnect P5, P9, P8, and P7 on MCU PWA. Slide MCU PWA from chassis. Set MCU PWA aside for reassembly.
3. Lay rear enclosure assembly on its side, with bottom of pump facing the technician.
4. Using a 1/4 inch nutdriver or medium flat blade screwdriver, remove the two screws from the bottom rear enclosure. Pull the main chassis assembly from the rear enclosure assembly. Set the rear enclosure assembly aside for reassembly.

6.2.10.3

MAIN CHASSIS REPLACEMENT

This procedure requires a 1/4 inch nutdriver or medium flat blade screwdriver, an X-acto knife, and mild solvent.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove and replace the main chassis, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7*.
2. Remove the subassembly components. Refer to the specific procedure under *Section 6.2.10, Rear Enclosure Assembly*.
3. Check the battery support pad on the main chassis. If defective, remove and replace.
4. Using an X-acto knife, remove the defective battery support pad. Carefully clean the chassis recess with a mild solvent to remove adhesive residue.
5. Peel the adhesive liner from a new battery support pad. Center the battery support pad into the chassis recess approximately 1/2 inch from the opening.
6. Check the cable clips on the main chassis. If defective, remove and replace.
7. Pry the cable clips loose from the main chassis with an X-acto knife. Remove old adhesive with a mild solvent prior to cable clips replacement.
8. Place the new adhesive-backed cable clips in the same chassis location as previous clips. Press firmly on the cable clips to secure.

   Note: Certain serial number units have the two cable clips molded into the chassis.

9. Place the new subassembly components into the new main chassis. Refer to the specific procedures under *Section 6.2.10*.
10. Slide the main chassis assembly into the rear enclosure assembly. Using a 1/4 inch nutdriver or medium flat blade screwdriver, fasten the two screws into the bottom rear enclosure.
11. Slide MCU PWA into chassis and connect to Power Supply PWA. Connect P5, P7, P8, and P9.
12. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8*.
13. Perform the Performance Verification Test as described in *Section 4.2*.

6.2.10.4

MECHANISM ASSEMBLY REMOVAL

This procedure requires a 1/4 inch nutdriver or standard flat blade screwdriver.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove the mechanism assembly, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Separate the main chassis assembly from the rear enclosure as described in *Section 6.2.10.2.*
3. Lay the main chassis assembly on its side. Use the 1/4 inch nutdriver to remove the 6-32 x 1/2 inch screw from the chassis bottom. Set the main chassis assembly upright.
4. Pull the cable assemblies through the MCU PWA slot to the rear of the chassis.
5. Remove the mechanism assembly by pulling it from the main chassis.

   Note: Do not damage the three harnesses or ribbon cable.

6.2.10.4.1

SENSOR/MCU CABLE ASSEMBLY REPLACEMENT

No tools are required for this procedure.

To remove and replace the Sensor/MCU cable assembly, proceed as follows:

1. Disconnect the Sensor/MCU cable assembly from the rear of the mechanism assembly.
2. Connect the new Sensor/MCU cable assembly to the mechanism assembly.

   Note: The colored edge of the Sensor/MCU cable assembly must be positioned towards the top of the mechanism assembly.

6.2.10.4.2

SHIELD AND GASKET REPLACEMENT

This procedure requires an X-acto knife.

To remove and replace the shield and gasket, proceed as follows:

1. Open the door handle completely. Pull the top of the shield downward and lift it from the mechanism. Do not damage the valve pins, plunger, or sensor.
2. Pry the defective gasket loose from the shield using an X-acto knife.
3. Route the new gasket into the gasket trough. Press the gasket firmly into the trough.
4. Replace the shield. Place the two shield tab protrusions into the large and small openings at the bottom of the mechanism. Pivot the shield upwards. Align the six

valve pins, plunger, and air bubble sensor into the openings in the shield. Snap the shield closed at the top of the mechanism.

6.2.10.4.3

BLACK BUMPERS REPLACEMENT

No tools are required for this procedure.

To remove and replace the black bumpers, proceed as follows:

1. Remove the defective black bumpers from the black nibs located on top of the mechanism.
2. Place the new black bumpers over the black nibs located on top of the mechanism.

6.2.10.4.4

DOOR HANDLE AND OPERATIONAL COMPONENTS REPLACEMENT

This procedure requires a small flat blade screwdriver.

Note: The door opener handle kit consists of: door opener handle; spring, door limit/retainer; retaining ring, E-Type, .188 ID; and door roller. This kit should be replaced as a single unit.

To remove and replace the door handle and operational components, proceed as follows:

1. Lay the mechanism assembly on its side. Hold the door handle against the mechanism chassis. Use a small flat blade screwdriver and remove the E-type retaining ring.
2. Lift and remove the door handle from the splined pivot rod.

   Note: Do not let the torsion spring eject the roller.

3. Hold the long leg of the torsion spring. To relieve tension from the torsion spring, use a small flat blade screwdriver and lift the leg over the splined pivot rod to the top of the mechanism.

   Note: Confirm the roller and flat spring are preassembled in the new door handle kit.

4. Prior to installing the new door handle kit, use the small flat blade screwdriver to move the long leg of the spring over the splined pivot rod and back into the chassis recess. The spring is now under tension.
5. Place the door handle kit, with flat spring facing out, on the splined pivot rod. Open the door handle approximately 60 degrees.

   Note: The long leg of the torsion spring is visible through the narrow slot off the pivot center of the door.

6. Hold the door firmly against the mechanism and insert the small flat blade screwdriver through the slot. Move the spring with the screwdriver, while pivoting the door handle to its closed position. The spring will snap into the roller groove when the door handle is nearly closed.

7. Press down on the door handle near the pivot point. The door handle seats on the splined pivot rod. Use the small flat blade screwdriver to install a new E-type retaining ring.
8. Confirm successful replacement of the door handle. Place the mechanism assembly upright. Open and close the door handle. If the door handle does not operate freely, repeat the Steps 1 through 7.
9. Refer to *Section 6.2.6, Cassette Door Subassembly and Cover Replacement*, to reassemble the cassette door to the mechanism assembly.
10. Perform the Performance Verification Test, as described in *Section 4.2*.

6.2.10.5

MECHANISM ASSEMBLY REPLACEMENT

This procedure requires a 1/4 inch nutdriver or flat blade screwdriver.

To replace the mechanism assembly, proceed as follows:

1. Route the mechanism cable and harnesses through the main chassis. Insert the mechanism assembly into the two guides on the main chassis, and slide the assembly to the rear.
2. Use the 1/4 inch nutdriver to attach the 6-32 screw through the main chassis to the mechanism assembly.
3. Route the cable and harnesses through the two cable clips on the main chassis.
4. Reassemble the main chassis and enclosure assemblies. Slide the main chassis assembly into the rear enclosure assembly. Using a 1/4 inch nutdriver or medium flat blade screwdriver, fasten the two screws into the bottom rear enclosure.
5. Slide the MCU PWA into the guides on the left side of the main chassis and connect P5, P7, P8, and P9.
6. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8*.
7. Perform the Performance Verification Test, as described in *Section 4.2*.

6.2.10.6

REAR ENCLOSURE REPLACEMENT

This procedure requires a 1/4 inch nutdriver or flat blade screwdriver, bushing installation and removal tool, electrician's knife, wire cutters, wire strippers, and wire crimpers.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove and replace the rear enclosure, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7*.
2. Separate the main chassis assembly from the rear enclosure as described in *Section 6.2.10.2*.
3. Set the rear enclosure upright, on a clean cloth or soft work surface, with the Power Supply PWA facing the technician.

4. Remove components and subassemblies per the specific procedures under *Sections 6.2.10.7, 6.2.10.8, 6.2.10.9,* and *6.2.10.10.*
5. Replace defective rear enclosure with new rear enclosure.
6. Reassemble components and subassemblies per the specific procedures under *Sections 6.2.10.7, 6.2.10.8, 6.2.10.9,* and *6.2.10.10.*
7. Reassemble the main chassis and enclosure assemblies. Slide the main chassis assembly into the rear enclosure assembly. Using a 1/4 inch nutdriver or medium flat blade screwdriver, fasten the two screws into the bottom rear enclosure.
8. Slide the MCU PWA into the guides on the left side of the main chassis and connect P5, P7, P8, and P9.
9. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8.*
10. Perform the Performance Verification Test as described in *Section 4.2.*

6.2.10.7

POWER SUPPLY PWA REPLACEMENT

This procedure requires a 1/4 inch nutdriver or flat blade screwdriver.

CAUTION: Use ESD safety and precautionary methods while working with electrostatic sensitive PWAs.

To remove and replace the Power Supply PWA, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Separate the main chassis assembly from the rear enclosure as described in *Section 6.2.10.2.*
3. Set the rear enclosure upright, on a clean cloth or soft work surface, with the Power Supply PWA facing the technician.
4. Disconnect the quick-disconnect terminals from J16 and J17 locations on the Power Supply PWA.
5. Using a 1/4 inch nutdriver, remove the two 6-32 x 1/4 inch hex head screws from the Power Supply PWA. Set the screws aside for reassembly.
6. Remove the defective Power Supply PWA. Place the new Power Supply PWA under the molded retaining nibs on right side of the enclosure. Align the Power Supply PWA over the two threaded bosses. Secure the Power Supply PWA to the enclosure with the two screws 6-32 x 1/4 inch hex head screws previously removed.
7. Reconnect the two quick-disconnect terminals to J16 and J17 as follows: black line to J16 terminal; white line to J17 terminal.
8. Slide the main chassis assembly into the rear enclosure assembly. Using a 1/4 inch nutdriver or medium flat blade screwdriver, fasten the two screws into the bottom rear enclosure.
9. Slide the MCU PWA into the guides on the left side of the main chassis and connect P5, P7, P8, and P9.
10. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8.*
11. Perform the Performance Verification Test, as described in *Section 4.2.*

6.2.10.8

INSULATOR REPLACEMENT

This procedure requires an X-acto knife with round blade, and a mild solvent. To remove and replace the insulator, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Separate the main chassis assembly from the rear enclosure as described in *Section 6.2.10.2.*
3. Set the rear enclosure upright, on a clean cloth or soft work surface. Remove the Power Supply PWA as described in *Section 6.2.10.7.*
4. Grasp the insulator and remove from the pole clamp backing plate. Using a mild solvent, clean the pole clamp backing plate of adhesive residue.
5. Obtain a new insulator. Remove the adhesive liner. Completely cover the backing plate with the new insulator, adhesive surface down. Press firmly to adhere the insulator to the backing plate.
6. Reassemble the Power Supply PWA as described in *Section 6.2.10.7.*
7. Slide the main chassis assembly into the rear enclosure assembly. Using a 1/4 inch nutdriver or medium flat blade screwdriver, fasten the two screws into the bottom rear enclosure.
8. Slide the MCU PWA into the guides on the left side of the main chassis and connect P5, P7, P8, and P9.
9. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8.*
10. Perform the Performance Verification Test, as described in Section 4.2.

6.2.10.9

POLE CLAMP EXTRUSION AND BACKING PLATE REPLACEMENT

This procedure requires a 5/16 inch nutdriver or flat blade screwdriver, an X-acto knife with round blade, and a mild solvent.

To remove and replace the pole clamp extrusion and backing plate, proceed as follows:

1. Confirm pump is disconnected from AC power. Separate the front and rear enclosure assemblies as described in *Section 6.2.7.*
2. Remove the subassembly components. Refer to the specific procedure under *Section 6.2.10, Rear Enclosure Assembly.*
3. Refer to *Section 6.2.3* to remove the pole clamp knob/screw assembly and tip insert.
4. Using a 5/16 inch nutdriver, remove the two 10-32 x 1/2 inch hex head screws from the backing plate and extrusion. Set the screws aside for reassembly. Remove the backing plate.
5. Remove the pole clamp extrusion from the rear enclosure, and replace with a new pole clamp extrusion.
6. Install the new pole clamp extrusion into the rear enclosure, and install a backing plate against the extrusion. Secure with the two screws previously removed.
7. Reassemble components and subassemblies as described in specific procedures.

8. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8.*
9. Perform the Performance Verification Test, as described in *Section 4.2.*

6.2.10.10

AC POWER CORD AND STRAIN RELIEF BUSHING REPLACEMENT

This procedure requires a 5/16 inch nutdriver or flat blade screwdriver, bushing installation and removal tool, electrician's knife, wire cutters, wire strippers, and wire crimpers.

To remove and replace the AC power cord and strain relief bushing, proceed as follows:

1. Confirm pump is disconnected from AC power.
2. Remove the subassembly components. Refer to the specific procedure under *Section 6.2.10, Rear Enclosure Assembly.*
3. Using a strain relief bushing tool, remove the defective bushing and discard.
4. Using a 5/16 inch nutdriver, remove the two 6-32 hex nuts from the ground screw. Remove the green wire and grounding lug. Set the ground screw and two nuts aside for reassembly.
5. Pull the defective AC power cord through the rear enclosure hole.
6. Push the new AC power cord through the rear enclosure hole. Leave several inches of cord inside the rear enclosure for wire terminal installation.
7. Remove approximately 2-1/2 inches of outer insulation from the end of the power cord. Three wires are exposed.

   Note: The two AC wires are black and white, and the ground wire is green.

8. Remove approximately 5/16 inch of insulation from each wire to permit installation of the wire terminals.
9. Using the wire terminal crimpers, install terminals on the wires as follows: black and white wires receive right angle crimp-type insulated quick-disconnect terminals. The green ground wire receives a red crimp-type insulated ring terminal to fit over a 6-32 screw thread. The three terminals are for wire size 14 - 16 AWG.
10. Using a bushing installation tool, install a strain relief bushing on the cord at the rear enclosure hole. Prior to securing the bushing, confirm that approximately three inches wiring and insulation are inside the rear enclosure. Secure the bushing.
11. Reassemble components and subassemblies as described in specific procedures.
12. Reassemble the front and rear enclosure assemblies as described in *Section 6.2.8.*
13. Perform the Performance Verification Test, as described in *Section 4.2.*

Section 7

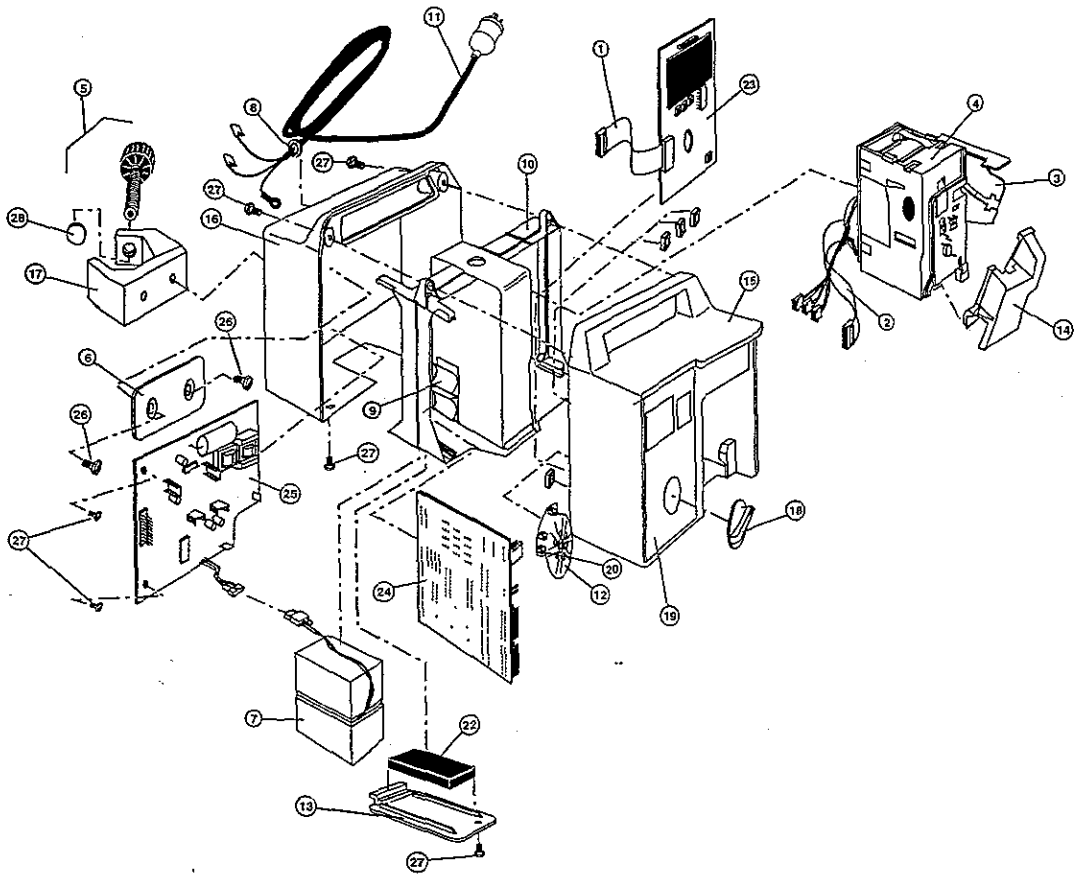
DRAWINGS

Table 7-1, Exploded View Callouts, presents the callout numbers, part names, and part numbers associated with *Figure 7-1. Figure 7-1, Exploded View*, presents an exploded view of the Flexiflo Quantum Enteral Pump. *Figures 7-2 through 7-12* present the interconnect diagrams, schematics, and functional block diagrams for the Flexiflo Quantum Enteral Pump.

Table 7-1. Exploded View Callouts

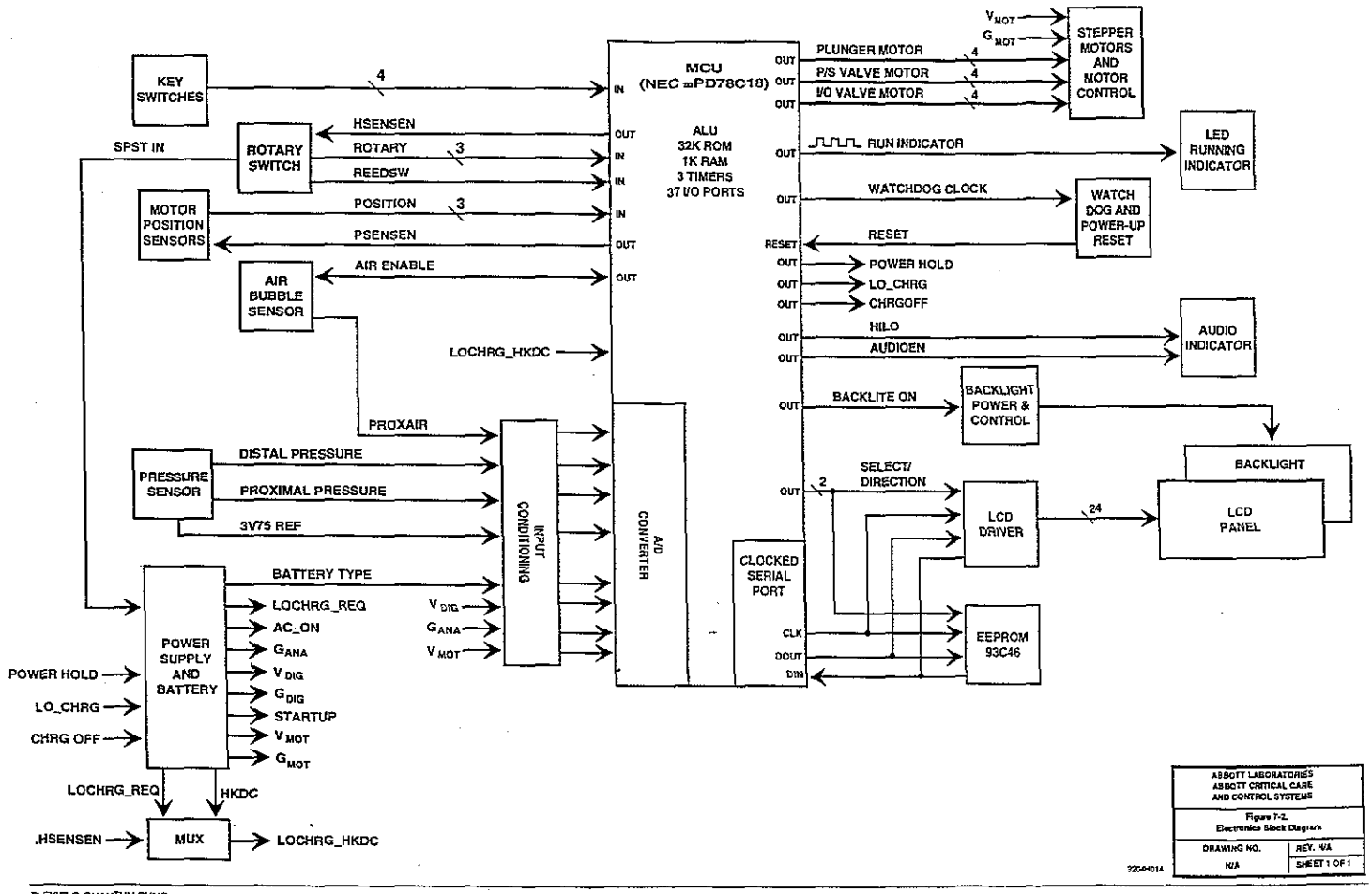
Callout Number	Part Name
1	Assembly, cable, MCU/Display
2	Assembly, cable, MCU/Sensor
3	Assembly, handle, door opener
4	Assembly, mechanism
5	Assembly, pole clamp knob/screw
6	Backing plate, pole clamp
7	Battery pack
8	Bushing, strain relief, black nylon
9	Cable clip, adhesive backed
10	Chassis, main
11	Cordset, AC power, hospital grade
12	Detent disk, knob
13	Door, battery
14	Door, front
15	Enclosure, front
16	Enclosure, rear
17	Extrusion, pole clamp
18	Knob, front panel control

Table 7-1. Exploded View Callouts	
Callout Number	**Part Name**
19	Label, front cover
20	Magnet (3)
21	Nut, KEPS, #10-32
22	Pad, battery door
23	PWA, Display
24	PWA, MCU
25	PWA, Power Supply
26	Screw, hex washer head, 10-32 x 1/2 inch
27	Screw, hex washer head, 6-32 x 1/2 inch
28	Tip insert, pole clamp



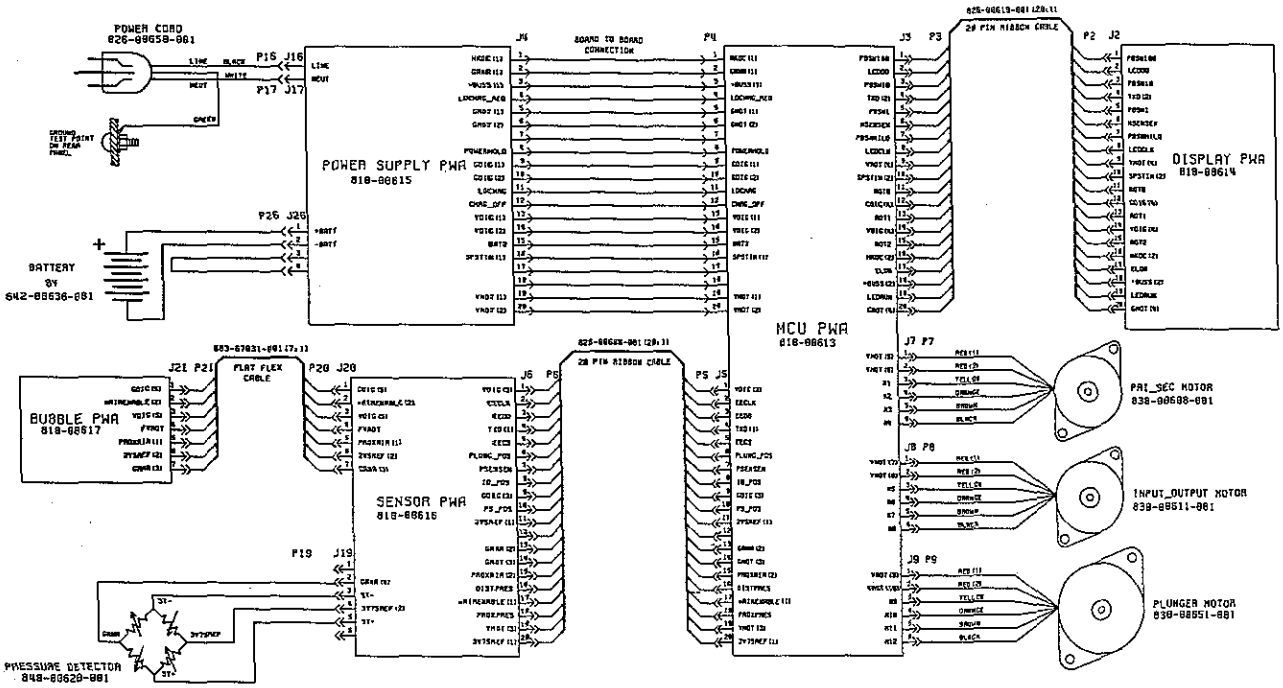
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-1. Exploded View	
DRAWING NO. N/A	REV. N/A SHEET 1 OF 1

9204-1013

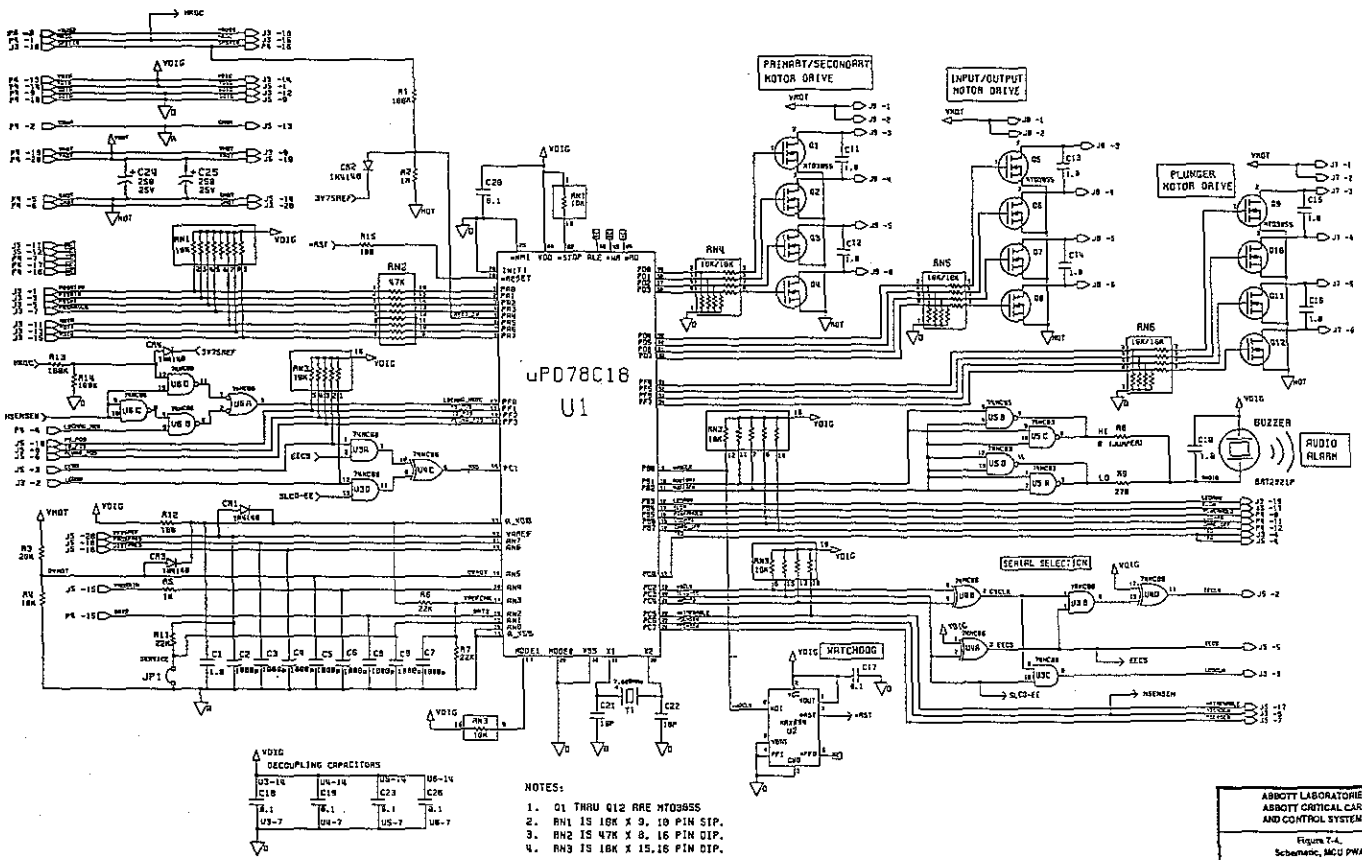


ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-2. Electronics Block Diagram	
DRAWING NO. N/A	REV. N/A
	SHEET 1 OF 1

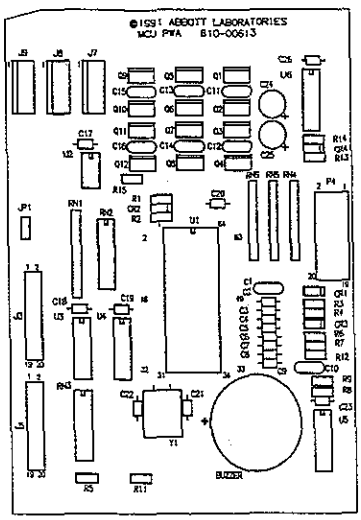
22044014



ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-3. Schematic, Interconnect	
DRAWING NO. 245-00500-001	REV. 2 SHEET 1 OF 1

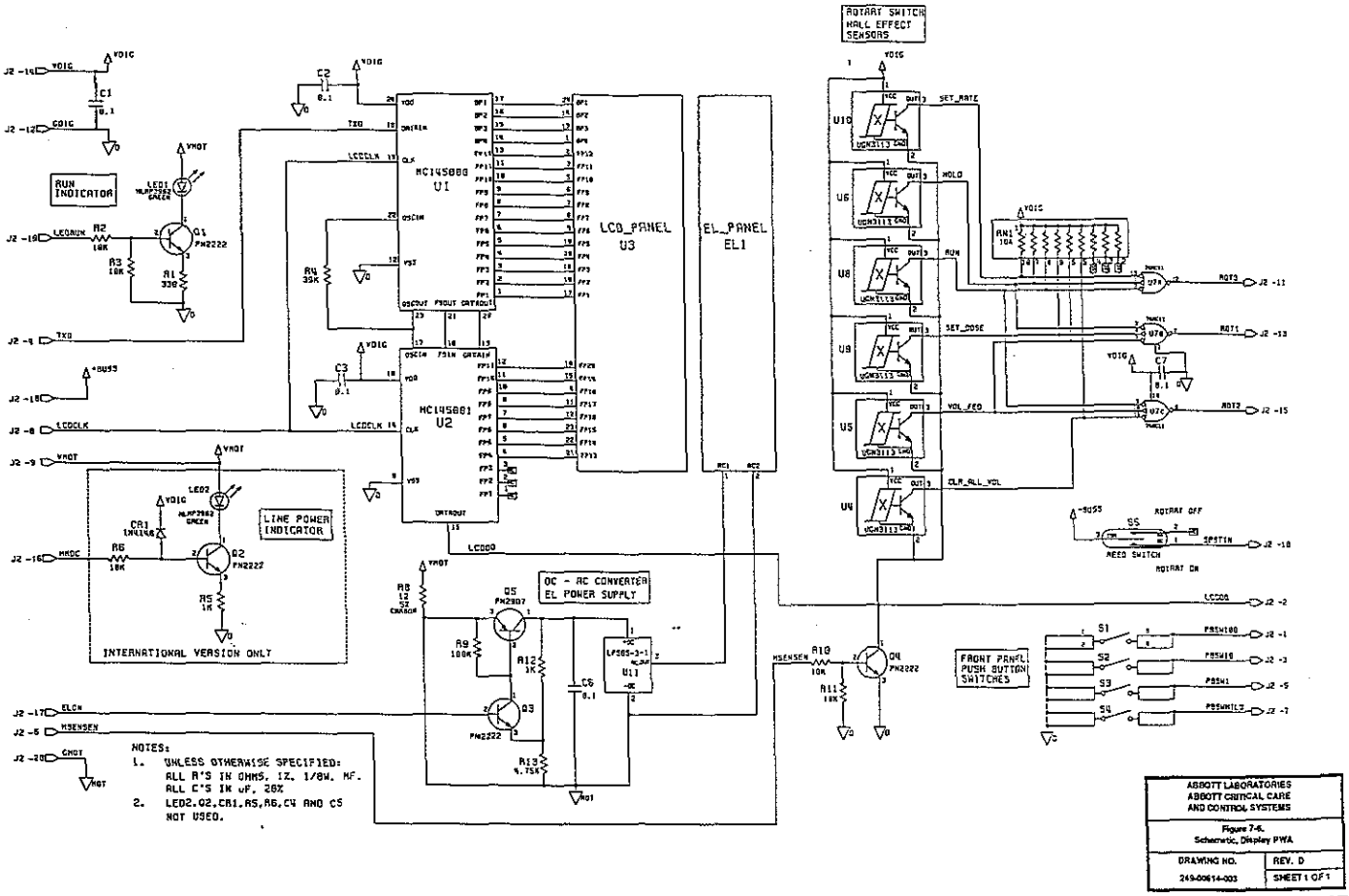


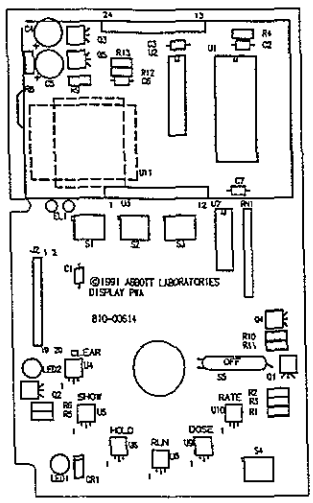
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-4. Schematic, MCU PWA	
DRAWING NO. 249-00613-003	REV. D SHEET 1 OF 1



SILKSCREEN

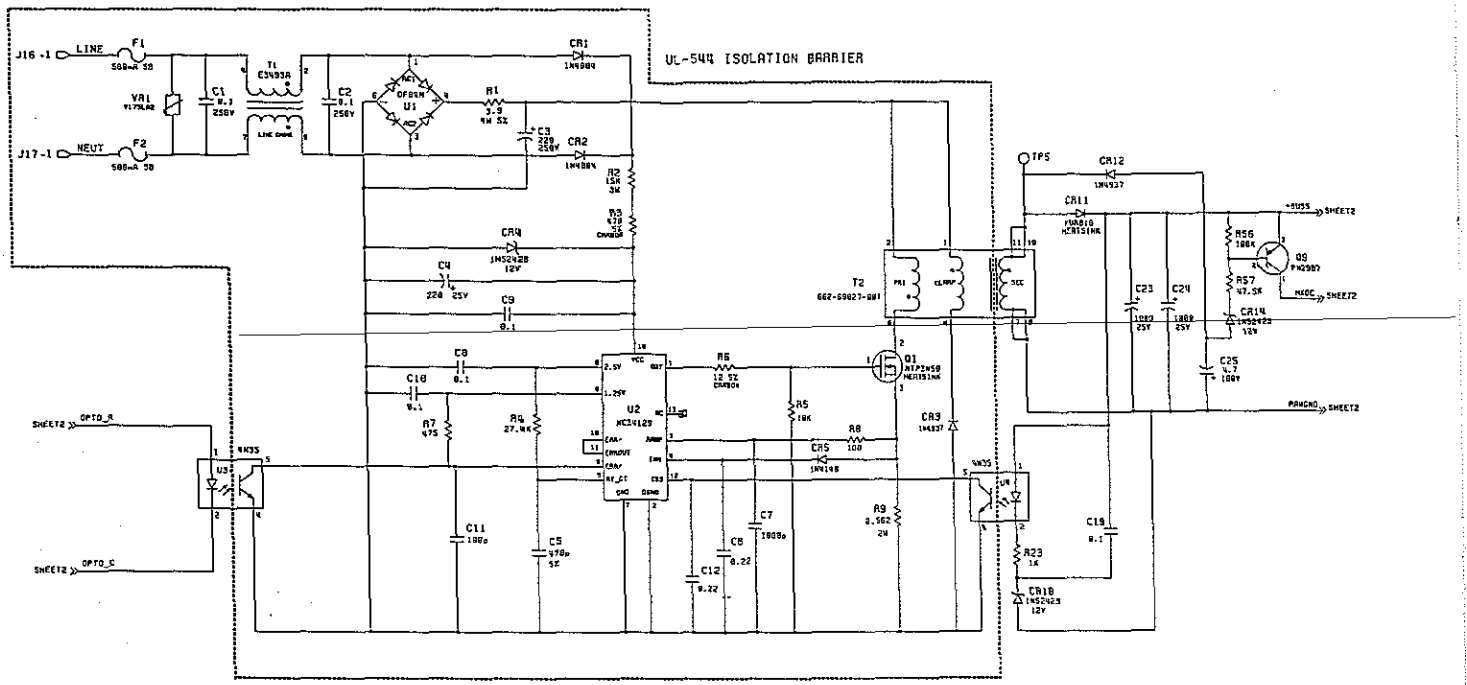
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-5. PWB Master, MCU Board	
DRAWING NO. 738-00613-003	REV. C SHEET 1 OF 1


ROTARY SWITCH HALL EFFECT SENSORS
RUN INDICATOR
LINE POWER INDICATOR
INTERNATIONAL VERSION ONLY
OC - AC CONVERTER EL POWER SUPPLY
FRONT PANEL PUSH BUTTON SWITCHES
LCD_PANEL U3
EL_PANEL EL1
MC145888 U1
MC145881 U2
REED SWITCH
NOTES:
1. UNLESS OTHERWISE SPECIFIED: ALL R'S IN OHMS, 1Z, 1/8W, MF. ALL C'S IN uF, 20%
2. LED2,Q2,CR1,R5,R6,C4 AND C5 NOT USED.
ABBOTT LABORATORIES
ABBOTT CRITICAL CARE AND CONTROL SYSTEMS
Figure 7-6. Schematic, Display PWA
DRAWING NO. 249-00614-003
REV. D
SHEET 1 OF 1



SILKSCREEN

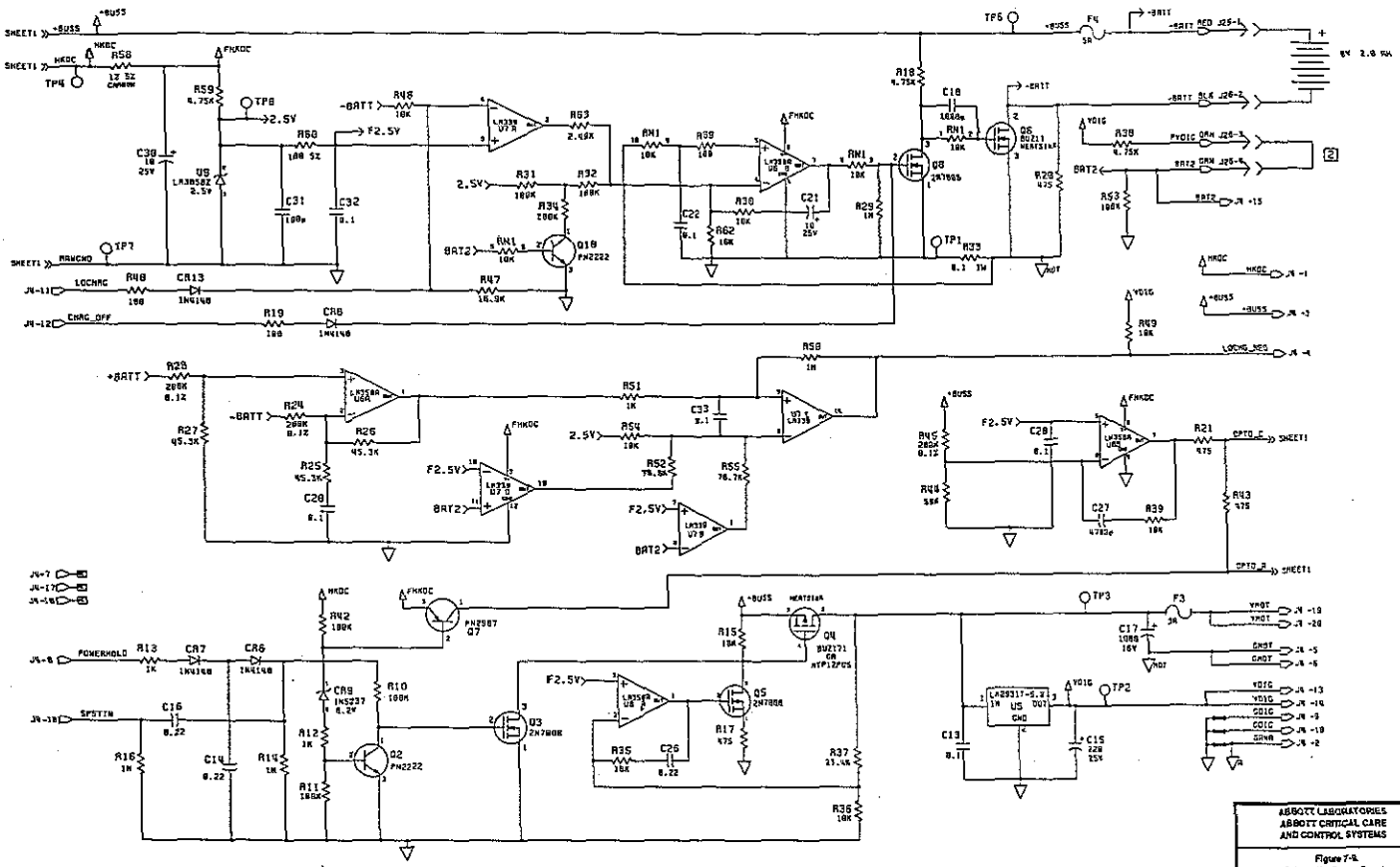
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-7. PWB Master, Display Board	
DRAWING NO. 738-00514-003	REV. C SHEET 1 OF 1



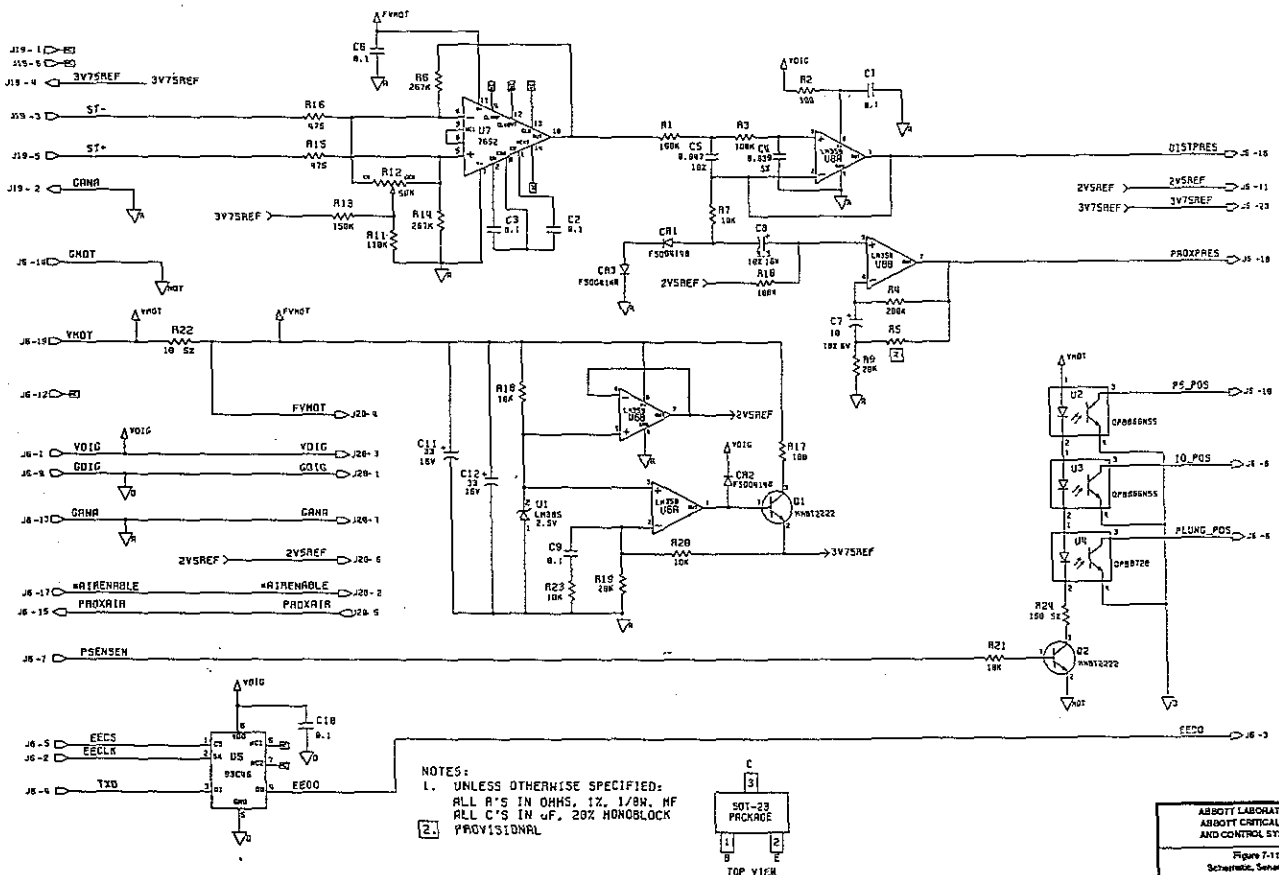
NOTES:

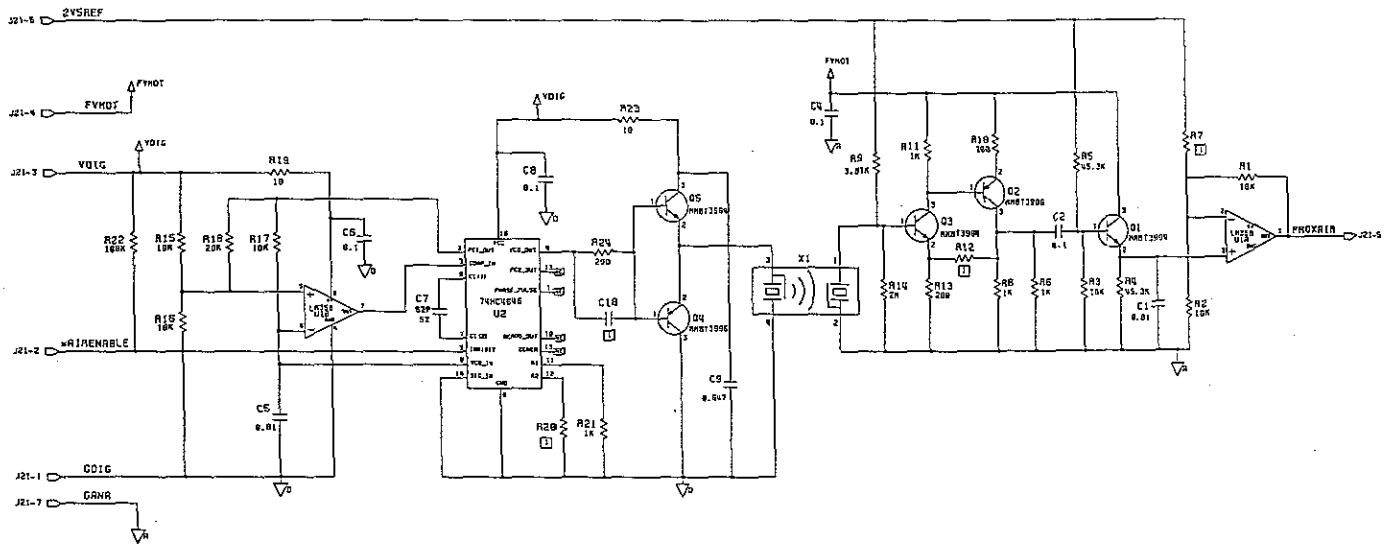
1. UNLESS OTHERWISE SPECIFIED:
   ALL R'S IN OHMS, 1%
   ALL C'S IN UF, 20%
2. J26 PINS 3 AND 4 RE SHORTED AT BATTERY'S CONNECTOR WHEN USING PANASONIC BATTERY.

ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-8. Schematic, Power Supply	
DRAWING NO. 249-00615-004	REV. C SHEET 1 OF 2



ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-8. Schematic, Power Supply	
DRAWING NO. 249-00615-004	REV. C SHEET 2 OF 2


J19-1
J19-5
J19-4
3V75REF
3V75REF
J19-3
ST-
J19-5
ST+
J19-2
CANA
J6-16
GNDT
J6-19
VKDT
J6-12
J6-1
VDIG
J6-8
GDIG
J6-13
CANA
2V5REF
2V5REF
J6-17
#AIMENABLE
#AIMENABLE
J6-15
PROXAIR
PROXAIR
J6-7
PSENSEN
J6-5
EECS
J6-2
EECLK
J6-6
TXD
EEDO
J6-3
FVKDT
VDIG
GDIG
CANA
2V5REF
#AIMENABLE
PROXAIR
PSENSEN
EEDO
3V75REF
2V5REF
VDIG
VKDT
FVKDT
GNDT
C6
0.1
R6
267K
R16
475
R15
475
R12
50K
R13
150K
R14
267K
R11
110K
C3
0.1
C2
0.1
U7
7652
R1
100K
R3
100K
C5
0.047
10Z
C4
0.039
5Z
R2
100
C1
0.1
U8A
LM358
U8B
D15TPRES
2V5REF
3V75REF
CR1
FSOO4148
CR3
FSOO4148
C8
1
10Z 16V
R7
10K
R10
100K
PROXPRES
R4
200K
R5
C7
10
10Z 6V
R9
20K
R22
10 5Z
R18
16K
C11
33
16V
C12
33
16V
U1
LM385
2.5V
R17
100
CR2
FSOO4148
Q1
MMBT2222
C9
0.1
R20
10K
R23
10K
R19
20K
U2
U3
U4
OPB866N55
OPB872B
P5_POS
IO_POS
PLUNG_POS
R24
100 5Z
R21
10K
Q2
MMBT2222
C10
0.1
93C46
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL R'S IN OHMS, 1%, 1/8W, MF
ALL C'S IN uF, 20% MONOBLOCK
2. PROVISIONAL
SOT-23
PACKAGE
TOP VIEW
ABBOTT LABORATORIES
ABBOTT CRITICAL CARE
AND CONTROL SYSTEMS
Figure 7-11.
Schematic, Sensor PWA
DRAWING NO.
249-00616-005
REV. E
SHEET 1 OF 1



NOTES:

1. PROVISIONAL
2. UNLESS OTHERWISE SPECIFIED:
   ALL R'S IN OHMS, 1Z, FILM, 1/8W.
   ALL C'S IN uF, 20Z, MONOBLOCK.

ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
Figure 7-12. Schematic, Bubble Sensor PWA	
DRAWING NO. 149-00617-003	REV. C SHEET 1 OF 1

Abbott Laboratories, Ross Products Division ***To Order, Dial 1 (800) 231-3330***

Quantum Parts

[redacted]

CODE	DESCRIPTION	PRICE	CODE	DESCRIPTION	PRICE
093	Velcro Strap	$0.81	652	Pole Clamp Extrusion	$14.50
600	Battery, Quantum	$46.77	653	Pole Clamp Insulator	$1.02
601	Battery Access Door	$1.89	654	Pole Clamp Tip Insulator	$0.60
602	Battery Door Pad	$0.72	655	Activation Switch Key	$0.90
603	Battery Support Pad	$0.40	660	Bushing, Strain Relief	$0.10
604	Battery Connector	$3.87	662	Cable Clip	$0.33
605	Display Board	$117.39	664	Main Chasis	$18.60
606	Door Assembly	$20.31	666	Detent Disk, Knob	$0.63
607	Door Cover	$3.95	668	Front Enclosure	$11.25
610	Front Panel Label	$8.10	669	Back Enclosure	$11.25
622	MCU Board	$96.35	670	Gasket, Front Cover	$1.70
630	Power Cord	$10.11	671	Gasket, Front Handle	$0.93
631	Manual, Operating, Quantum	$1.00	672	Gasket, Knob	$0.40
632	Power Supply Board	$157.89	674	Control Knob, Front Panel	$0.75
633	Manual, Service, Quantum	$55.00	675	Magnet (quantity 3)	$1.90
640	Slo-Blo Fuse	$1.75	676	Foot Pad (quantity 4)	$1.80
645	Cable Assembly, MSU/Display	$3.75	680	Shield Mechanism	$1.90
646	Cable Assembly, MSU/Sensor	$4.02	682	Snap Retainer, Knob	$0.30
650	Pole Clamp Knob/Screw Assembly	$11.30	684	Washer, Knob	$0.20
651	Pole Clamp Backing Plate	$3.12	685	Write-on Label	$1.79

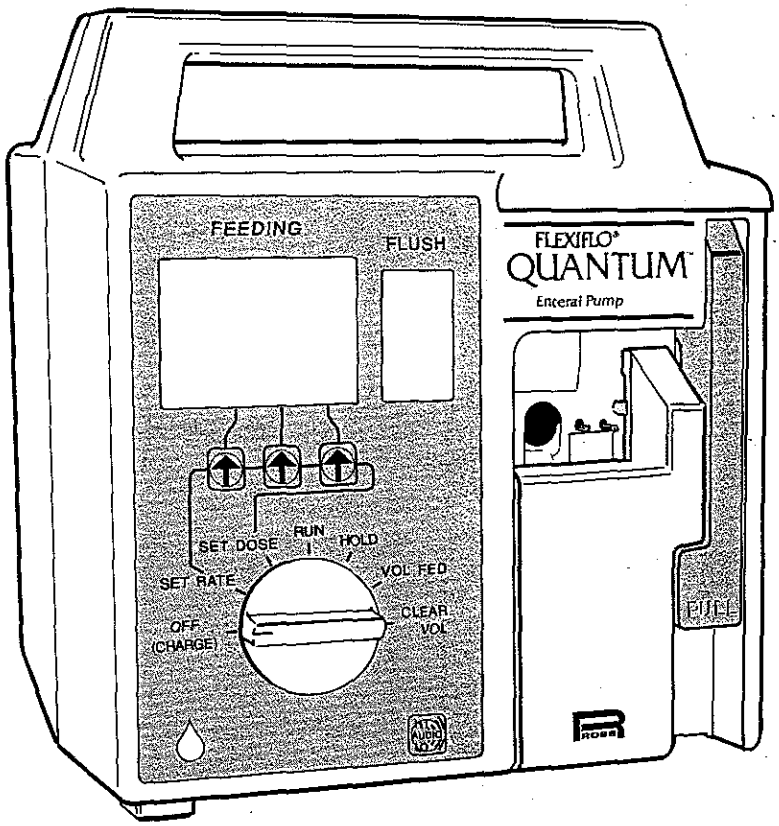
FREE PUMP EXCHANGE (NEW S/N)

No. 50596–Purchase
No. 50598–Lease/Rent

FLEXIFLO® QUANTUM™ Enteral Pump

OPERATING MANUAL

For Enteral Use Only
Not For Parenteral Use



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USER QUALIFICATIONS

The Flexiflo Quantum Enteral Pump is for use at the direction of or under the supervision of licensed physicians, and by licensed or certified health care professionals who are trained in the use of the pump and the administration of enteral fluids.

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PUMP CHARACTERISTICS

The FLEXIFLO® QUANTUM™ Enteral Pump is a microprocessor-(computer-) controlled pump that provides for accurate, controlled enteral feeding in a safe, user-friendly system. The Quantum Pump is a volumetric pump that uses a specially designed feeding set, which includes a cassette that delivers measured amounts of enteral product. As an optional feature, the Quantum Pump will flush the feeding set and indwelling feeding tube each hour with a 25-mL flush.

PRECAUTION: This pump is designed to deliver only a liquid enteral feeding product (standard liquid product, infant formula or reconstituted powder product that has been thoroughly mixed into solution).

The Quantum Pump offers these features:

1. Automatic priming (no manual priming is necessary)
2. Automatic flush feature
3. Dose setting
4. Protection against overdelivery:
   - Motor speed is continuously monitored
   - Senses malfunctions that could result in gravity flow
5. Volume-fed accumulation displays for enteral product and flush solution
6. Flow-rate selection from 1 to 300 mL/hr in 1 mL/hr increments
7. Accuracy to ± 10% (refer to CHECKING PUMP ACCURACY, page 13)
8. 8-hour battery operation at 125 mL/hr, when fully charged
9. Alarms:
   - OCCLUSION
   - EMPTY
   - DOSE COMPLETE
   - TURN TO RUN
   - LOW BATTERY
   - DOOR/CASSETTE
   - SET RATE
10. System self-check
11. Adjustable alarm volume
12. User-friendly operating controls
13. Simple setup (one-hand cassette loading)
14. Memory—Automatic retention of the following values until turned off and disconnected from AC power:
    - **FEED** and **FLUSH** volume accumulations **(VOL FED)**
    - **SET RATE**
    - **SET DOSE** values

PEDIATRIC USE

Because the Flexiflo® Quantum™ Pump (when FLUSH sets are used in the Optional FLUSH MODE) will deliver at least 600 mL of additional fluid (flush solution) per day on continuous feeding, **the FLUSH sets must NOT be used for feeding infants under 12 months of age. In addition, use of the FLUSH feature in all pediatric patients 12 months of age or older must be carefully evaluated:** A physician, who has training in pediatrics, must take into account the effect of this additional volume on intestinal tolerance and overall fluid balance of the individual patient and should, accordingly, determine the maximum amount of flush solution to be hung.

CAUTION

The Quantum Pump can be used on pediatric patients provided the patients can tolerate a feeding range within the pump operational specifications. Those specifications are:

- The flow rate range of the Quantum Pump is 1-300 mL/hr in 1 mL increments.
- The flow rate accuracy of the pump is ± 10% (see page 13 of the Quantum operating manual for checking pump accuracy).
- The mean occlusion pressure limit of the Quantum Pump is 15 PSI.

If these specifications are not appropriate for a given patient, the Quantum Pump should not be used.

All enteral pumps have the potential to bolus-feed or overdeliver, which is an important consideration in feeding volume-sensitive patients. In these patients, a volume of product no more than four times the hourly feeding rate should be hung.

PRECAUTIONS

Caution should be exercised in the use of this pump in the Automatic Flush Mode for patients with volume sensitivity or fluid restriction (ie, cardiac, renal, pulmonary or pediatric patients). For such patients, the Feed Only Mode (using the system without automatic flush feature) may be desired.

NOT FOR PARENTERAL USE

Confirm proper placement and function of patient's enteral feeding tube (nasogastric, jejunostomy, gastrostomy, etc). Failure to do so may result in vomiting and/or aspiration. Verify the following before initiating feeding:

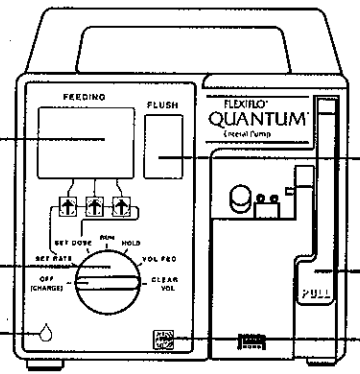
1. A Quantum Pump Set is being used.
2. Cassette is properly seated in pump and door is closed.
3. Flow rate is set at the prescribed mL/hr.
4. Before putting pump in RUN mode, be sure line clamps are fully open.
5. If a pump set with flush bag is used, be sure both line clamps are closed during setup and when the door on the pump is open. Otherwise, the fluids will mix.

For optimum operation, observe the following precautions: Low level electrical emissions are commonly observed when fluids are administered using an enteral feeding pump. The emissions observed with the QUANTUM pump may create artifacts on voltage sensing equipment such as ECG, EMG, and EEG monitoring devices if the monitoring device is not operating correctly or has loose or defective connections to its sensing electrodes. These artifacts may be mistaken as actual physiologic signals, and may vary at a rate that is associated with the delivery rate set on the pump. To determine if the abnormality in the monitoring device is caused by the QUANTUM pump, set the pump so it is temporarily not delivering fluid. Disappearance of the artifact indicates it was probably caused by the pump. Proper setup and maintenance of the **monitoring de** should eliminate the artifact.

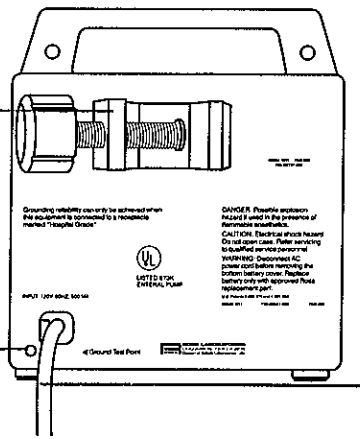
PANEL DISPLAYS

Here is a simple explanation of the panel displays. Understanding them is necessary for successful operation of the pump.

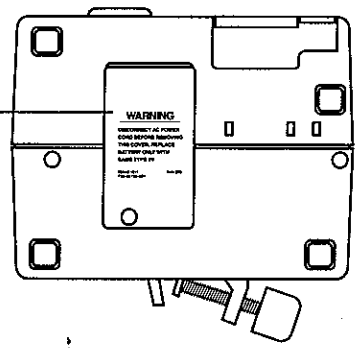
FRONT PANEL



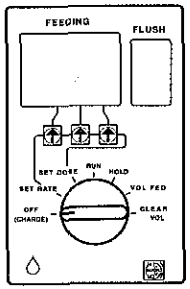
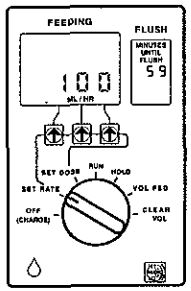
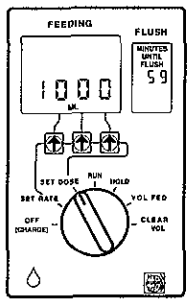
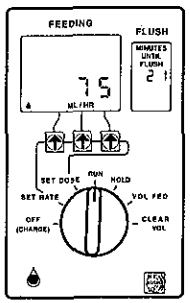
BACK PANEL



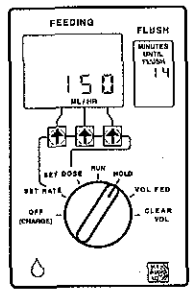
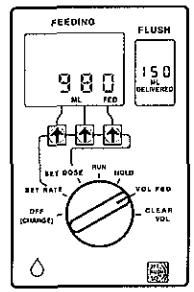
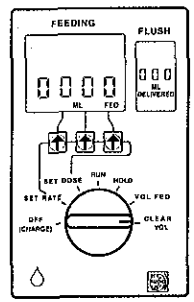
BOTTOM VIEW



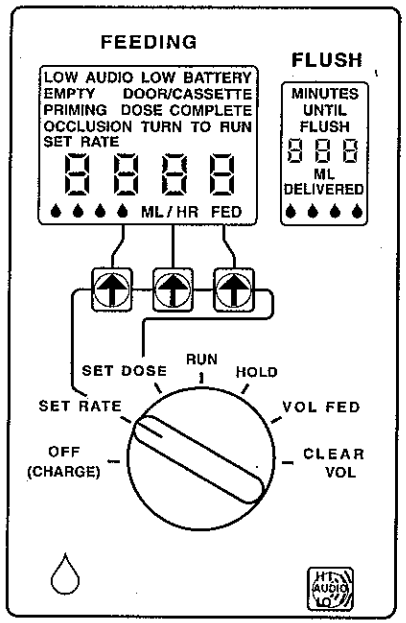
CONTROL DIAL SETTINGS

DIAL:		FUNCTION:
OFF (CHARGE)		Stops all pump functions. Battery charges in all dial settings when pump is plugged in. The pump will retain current **RATE, DOSE** and **VOL FED** values indefinitely *unless* the pump is unplugged from an AC power source while in the **OFF (CHARGE)** setting.
SET RATE		Allows flow rate to be set (1 to 300 mL/hr in 1-mL increments) by pressing the keypad arrows when the pump is in the **SET RATE** mode. Rate may be set during or after the automatic priming phase.
SET DOSE		Allows dose to be limited (1 to 1999 mL for Models A, B & C and 1 to 9999 mL for Model D and higher, in 1-mL increments) by pressing the keypad arrows. Completion of this dose triggers **DOSE COMPLETE** alarm. Refer to **DOSE COMPLETE** (page 14). DOSE may also be set during the automatic priming phase. **NOTE:** If zero dose is entered (0000), this feature is deactivated.
RUN		Only setting that activates feeding. Visual display shows rate of flow in mL/hr and a droplet-shaped image will move across the bottom of the visual display. Also, a small green light on lower left-hand corner of pump will flash when pump is in **RUN** mode.

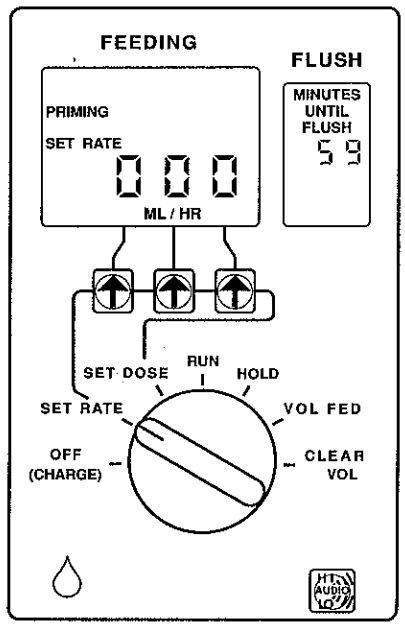
CONTROL DIAL SETTINGS (continued)

DIAL:		FUNCTION:
HOLD		Stops pumping action and audio alarms. **HOLD** is used when correcting an alarm condition or whenever temporary cessation of pumping action is desired (such as when connecting a new feeding container). If pump dial is left on **HOLD** for more than 5 minutes, an alarm will sound and the message **TURN TO RUN** will be displayed.
VOL FED		Stops pumping action. The **FEEDING** display will show feed volume delivered and the **FLUSH** display will show flush volume delivered. Pump accumulates feed volume delivered up to 9999 mL and flush volume up to 999 mL unless these volumes are reset to zero by turning to **CLEAR VOL** (or the pump is unplugged while in the **OFF (CHARGE)** mode). Upon exceeding the maximum feed or flush volume allowed on the display, the value turns to zero and a new accumulation begins.
CLEAR VOL		Stops pumping action and clears to zero both the feed and flush volume fed. **NOTE:** The pump will "beep" four times before erasing volumes to alert the user that the dial has been turned to **CLEAR VOL.** The user must turn dial away from **CLEAR VOL** (to any other setting) *before* the fourth beep to avoid an unintentional erasure of volume total(s). **CLEAR VOL** does not work while pump is priming.

AUTOMATIC PRIME



System Self-Check Display



Priming Display

Automatic Priming is initiated when:
Pump dial is turned from **OFF (CHARGE)** position to **SET RATE, SET DOSE** or **RUN** position. The system self-check on the pump is followed by automatic priming of the set. Fluid fills the tubing during this priming sequence. This fluid is not counted in **VOL FED.**

NOTE: Automatic priming expels air from the set, which may result in a small amount of fluid being expelled beyond the adapter on the feeding set.

Automatic Priming does not occur in the following dial settings:

HOLD
VOL FED
CLEAR VOL

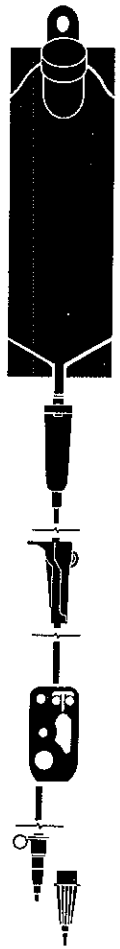
PUMP SETS

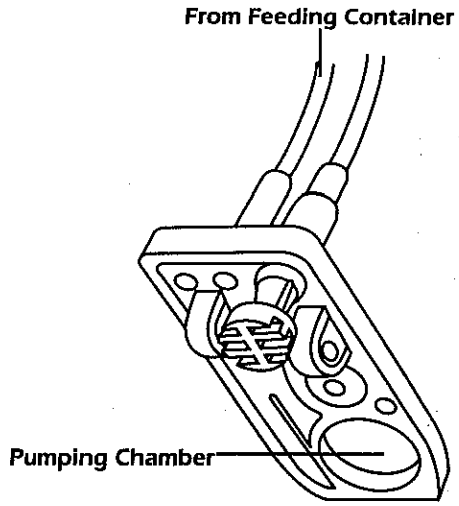
The Quantum Pump offers a wide choice of feeding sets with either a Pump Set Without Flush Bag (single inlet cassette) or a Pump Set With Flush Bag (dual inlet cassette).

PUMP SET (WITHOUT FLUSH BAG)—SINGLE INLET CASSETTE

EXAMPLE SHOWN:

FLEXIFLO® Top-Fill Enteral Nutrition Bag
With Preattached Quantum™ Pump Set





SINGLE INLET CASSETTE

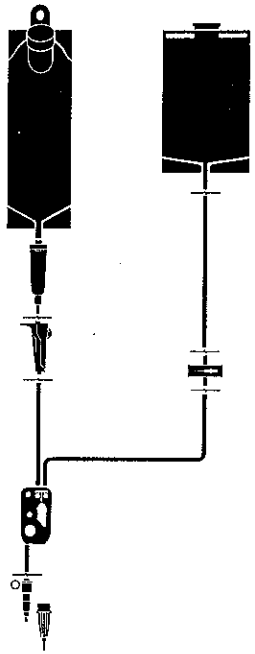
IMPORTANT REMINDER WHEN USING A PUMP SET (WITHOUT FLUSH BAG):
- **FLUSH** display will be blank when a single inlet cassette is used.

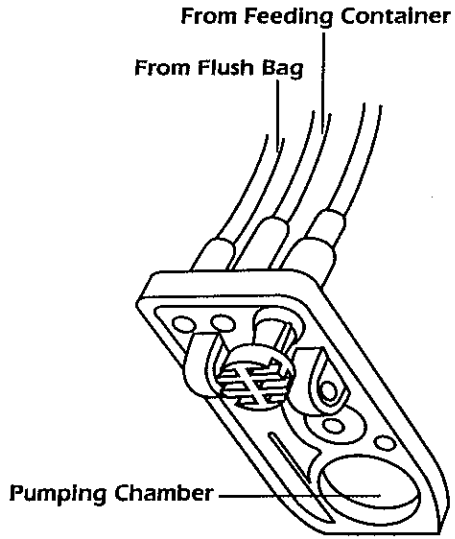
PUMP SETS (continued)

PUMP SET WITH FLUSH BAG—DUAL INLET CASSETTE

EXAMPLE SHOWN:

FLEXIFLO® Top-Fill Enteral Nutrition Container
With Preattached Quantum™ Pump Set With Flush Bag





DUAL INLET CASSETTE

IMPORTANT REMINDER WHEN USING FEED/FLUSH SETS:

- Every 60 minutes of continuous feeding *AND* before the pump alarms **EMPTY**, **DOSE COMPLETE** or **LOW BATTERY**, 25 mL of flush solution will be delivered over 1½ minutes. Flush rate is fixed at 999 mL/hr.
  NOTE: The **FLUSH** cycle will be aborted if the control knob is turned to any position other than **RUN, HOLD** or **VOL FED.**
- Assure that the clamp on the filled flush bag is open during priming. Otherwise, the pump will "decide" that a Pump Set (Without Flush Bag) is in place and the **FLUSH** display will remain blank.
- When the door on the pump is open, be sure both clamps are closed. Otherwise, the fluids will mix.
- Use of the Quantum Pump replaces the need for *routine* flushing procedures (eg, 20-30 mL of warm water every 3-4 hours during *continuous* feeding).
- Flushing with 20-30 mL of warm water (using a 30-mL or greater syringe) before and after medications is still recommended.
- If pump feeding is manually stopped or turned off, automatic flushing does not occur. If pump remains in the **OFF (CHARGE)** mode (not on **HOLD**), it is recommended to flush with 20-30 mL of warm water (using a 30-mL or greater syringe) to rinse remaining product from the feeding set.
- Additional information or action may be included in your facility's required procedure

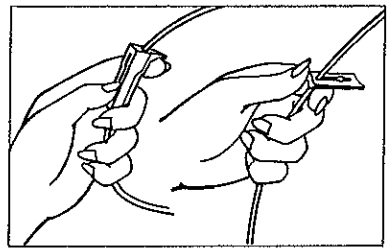
INSTRUCTIONS FOR USE

Before initial use on battery power and after extended storage periods, the pump must be plugged into an AC power source for a minimum of 8 hours (pump may be operated during this time). The pump should be operated on battery power for a minimum of 6 continuous hours at least once every 6 months for best performance and battery life. Use AC power whenever possible. Plug in during storage to assure a fully charged battery for emergencies.

DANGER: Possible explosion hazard if used in the presence of flammable anesthetics.
ASSURE THAT ALL CLAMPS ON FEED AND FLUSH SETS ARE CLOSED BEFORE SETUP.

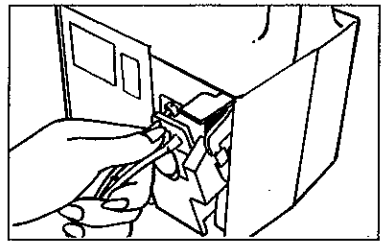
TO ASSEMBLE:

1. Attach pump to stand using pole clamp. Plug in cord if power is available. If using battery power, do not let battery run down. When the low battery message appears, the battery has approximately 30 minutes of energy left.
2. Close CAIR® Clamp* (flow regulator)† on Quantum Pump feeding bag (and slide clamp on flush bag, if used).

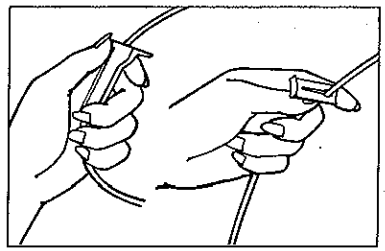


3. Attach the Quantum Pump Set securely onto a filled enteral nutrition container, if it is not preattached. Suspend container to side or behind and 20 inches above pump. Squeeze sight chamber ⅓ to ½ full.
4. Fill flush bag with enteral flush solution **(DO NOT USE CARBONATED SOLUTIONS).** Suspend bag to side or behind and 20 inches above pump.
5. Lift blue lever on face of pump to open door. Make sure orange plunger knob is oriented to the left as you firmly seat cassette into pump cavity. Close door on pump by pushing the blue lever down.

   (See illustration top of next column.)

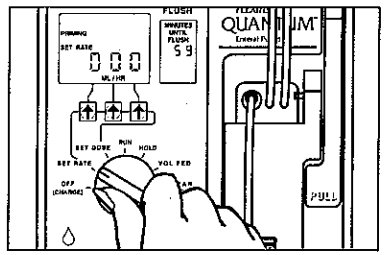


6. Fully open clamp on feeding set (and slide clamp on flush bag, if used).



TO PRIME:
Pump automatically primes

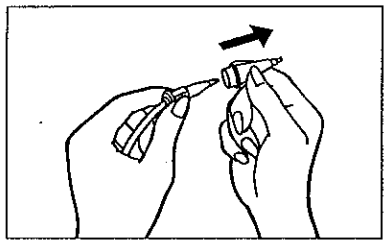
7. Turn pump dial to **SET RATE.** Pump will initiate system self-check procedure, followed by automatic priming of the set.



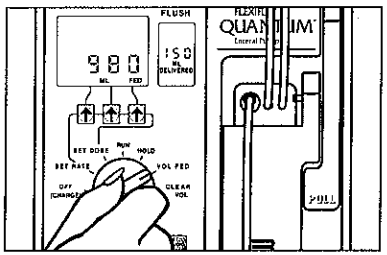
NOTE: Automatic priming expels air from the set, which results in a small amount of fluid being expelled beyond the adapte

INSTRUCTIONS FOR USE (continued)

8. Confirm proper placement and function of enteral feeding tube.
9. **Remove cover** from adapter and attach to enteral feeding tube.
   NOTE: If adapter is used with cover in place, assure that set is connected *ONLY* to an enteral feeding tube (eg, needle-catheter jejunostomy).



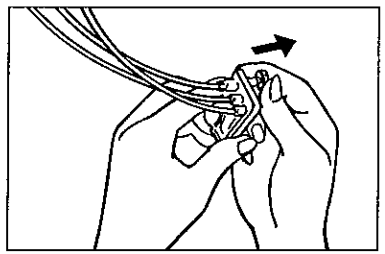
10. Select flow rate, from 1 to 300 mL/hr, by pressing individual arrows. Never use sharp objects such as pens, pencils, fingernails or paper clips to depress the keypad arrows.
11. If desired, turn dial to **SET DOSE** and select dose by pressing individual arrows.
    NOTE: If zero dose is entered (0000), this feature is deactivated.
12. Turn dial to **RUN** to start feeding.
13. To see feeding volume delivered (and flush volume delivered, if this feature is used), turn dial to **VOL FED.**



14. To clear the feeding and flush volume delivered, turn dial to **CLEAR VOL.** (This occurs after four beeps.)
    NOTE: If alarm sounds, turn pump dial to **HOLD.** Correct alarm condition indicated by visual display, then turn pump dial to **RUN** to restart feeding. (For explanation of alarms, see pages 14-15.)
15. When desired, disconnect pump-set tubing from patient's enteral feeding tube. Close clamp on feeding bag (and flush bag, if used). Lift blue lever on face of pump, remove cassette and discard set and container.
16. When feeding is complete, turn pump dial to **OFF.**
    NOTE: Pump stops and sounds an alarm automatically when the container is empty. If the DOSE function is in use, the pump will stop, sound the alarm and display the **DOSE COMPLETE** message when the selected dose is reached.
    PRECAUTION: The pump set and container should be replaced as needed, or at least every 24 hours, to avoid product-contamination problems. For single-patient use only.

TO GRAVITY FEED OR MANUALLY PRIME:

1. Completely close CAIR® clamp (and slide clamp, if flush set is used).
2. Remove cassette from pump.
3. Pull out orange plunger knob and regulate flow with CAIR clamp.



*CAIR® clamp manufactured under license from Adelberg Laboratories, Inc. Covered by one or more of the following U.S. Patent Nos: 3,685,787; 3,893,468; 4,013,263; 4,047,694; 4,238,108; 4,181,476.

† If desired, CAIR clamp may be used to regulate flow rate by gravity, but all tubing must be completely disconnected from pump. This set delivers approximately 14 drops per mL.

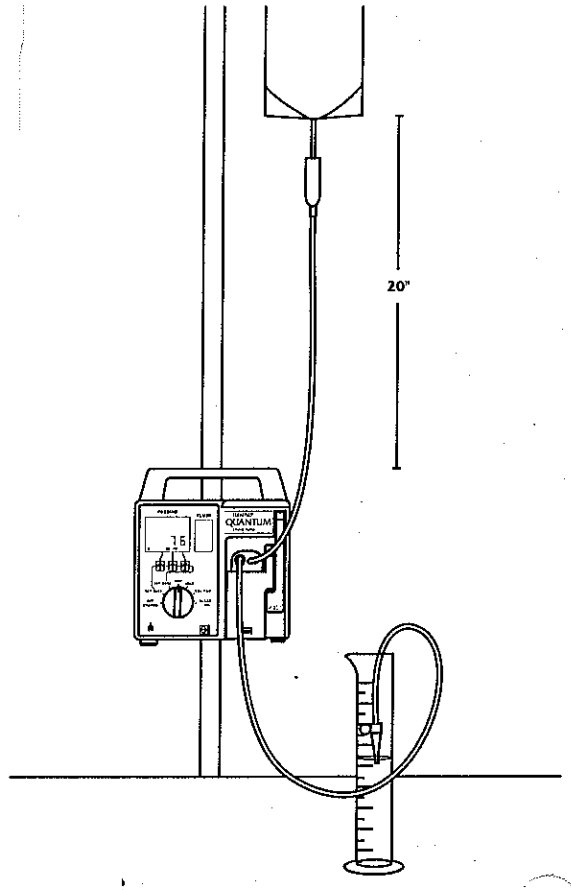
CHECKING PUMP ACCURACY

Fluid head height and viscosity are two variables that can affect flow rate. To check flow rate, use the following procedure:

Select a pump set *without a flush bag* (or fully close clamp on flush bag, if using a feeding pump set with flush bag). Be sure to use a graduated cylinder for volume measurement—not an enteral container. Using Ensure® Complete, Balanced Nutrition™ or Osmolite® Isotonic Liquid Nutrition, fill the feeding container only and set up pump according to instructions. Suspend bag to side or behind and 20 inches above pump (see illustration). With a test pump connected to AC power, start the pump and let it run for 15 minutes. Then run product into a graduated cylinder for 30 minutes and compare to rate set on pump:

Rate Set		Amount Expected in Graduated Cylinder @ 30 minutes
76 mL/hr	=	34.2 mL to 41.8 mL
150 mL/hr	=	67.5 mL to 82.5 mL

If flow rate is incorrect, try a new pump set and repeat procedure.



TROUBLE-SHOOTING

The Quantum Enteral Pump is designed to be highly reliable. As with any electro-mechanical device, however, problems may occur. The following tips will help correct minor in-service problems that may arise:

Intermittent audio alarms are accompanied by messages on the front panel indicating the cause of the alarm for all alarm conditions except **LOW AUDIO** (visual only), which indicates low alarm volume has been selected.

VISUAL DISPLAY OR PROBLEM	CORRECTIVE ACTION
OCCLUSION—Flow has stopped.	■ Turn dial to **HOLD.** ■ Clear obstruction/check for kinked tubing or closed clamps. ■ Turn dial to **RUN** to start pump.
EMPTY—Feed or flush bag empty.	■ Turn dial to **HOLD.** ■ Refill container(s). ■ Turn dial to **RUN** to start pump.
DOSE COMPLETE—VOL FED is equal to the **SET DOSE.** Pump stops.	■ Turn dial to **SET DOSE.** ■ Press keypad arrows to increase dose OR to zero dose setting OR turn dial to **CLEAR VOL.** ■ To silence alarm, turn dial to **HOLD,** then **RUN.**
SET RATE—Dial turned to **RUN** without entering rate.	■ Select flow rate (1 to 300 mL/hr). ■ To silence alarm, turn dial to **HOLD,** then **RUN.**
TURN TO RUN—Pump dial in setting other than **RUN** or **OFF** more than 5 minutes.	■ Turn the dial to **HOLD** or **RUN** to reset.
DOOR/CASSETTE—Door open, cassette not properly loaded or excess foam or air in cassette.	■ Confirm cassette in place and close door. ■ Manually reprime to remove foam or air from cassette. ■ Replace set. ■ If alarm condition persists, pump requires service.

TROUBLE-SHOOTING (continued)

VISUAL DISPLAY OR PROBLEM	CORRECTIVE ACTION
LOW BATTERY—Pump has approximately 30 minutes of battery operation before complete shutdown. A completely blank front panel (no lights, symbols, message) indicates that the battery is depleted and the unit is not plugged into a live AC circuit. **NOTE:** Complete shutdown is preceded by a continuous alarm for 1 minute.	■ Plug power cord into AC outlet. ■ Turn dial to **HOLD,** then **RUN.** Pump will operate normally while battery is charging.
ERR—System Malfunction.	■ Must turn pump **OFF** to reset. If alarm condition persists, pump requires service.
FLUSH Display Blank with FEED/FLUSH SET in use—Clamp is closed on the Flush Bag or Flush Bag is empty.	■ Turn pump **OFF.** ■ Fill Flush Bag. ■ Open clamp. ■ Restart pump.

CLEANING

There are no routine calibration or adjustment procedures required with the Quantum Pump. All servicing or adjustments should be referred to qualified technical personnel (refer to Service Manual).

For trouble-free operation, check the pump daily and clean immediately after spills occur.

While cleaning, pump should be turned off and unplugged.
Do not submerge, autoclave, heat, steam, ETO or radiation sterilize the pump.

THE PUMP CAN BE CLEANED AS FOLLOWS:

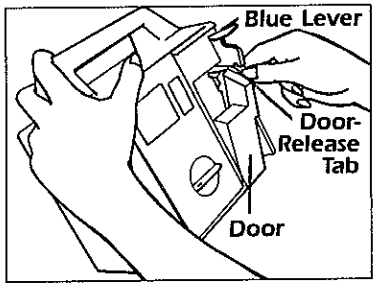
HOUSING

- Clean outside surface with soft cloth and warm, soapy water.
- For general cleaning, use dishwashing detergent (nonchlorine-based) or isopropyl alcohol.
- For general disinfecting, use 70% concentration isopropyl alcohol.
- For disinfecting after exposure to AIDS or hepatitis, use 10% concentration of 5.25% sodium hypochlorite (household bleach). This solution may discolor the pole clamp. **DO NOT SPRAY THIS SOLUTION INTO PUMP CAVITY.** After exposure to tuberculosis, use 70% concentration isopropyl alcohol. These recommendations are not substitutes for official procedures that may differ among institutions.

PUMP CAVITY

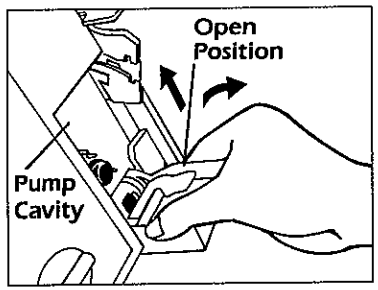
To facilitate cleaning, the cassette receptacle door may be disconnected from the face of the pump. However, this should be removed only by a qualified service technician, in the following manner:

- Tilt pump back.
- Lift blue lever so cassette door is in open position.
- Push out on door-release tab to release cassette door.
- Allow door to open fully.
- Lift up on door to remove completely from brown hinge.



Reinstall cassette door by following above procedures in reverse order.

- Do not spray water or cleaning solution into pump cavity.
- Clean with a cotton swab, soft brush or soft cloth and warm soapy water.
- Dry thoroughly.
- Be sure no soap film or residue is left in the pump cavity.



STORAGE

- The pump should be stored away from excessive heat, cold or humidity.
- Be sure pump dial is in the **OFF** position.

SERVICE

- The Quantum Enteral Pump is designed to be highly reliable. As with any electro-mechanical device, however, minor problems may occur. In the event of a pump malfunction, need for technical assistance or parts, please contact Ross.
- OPERATING INSTRUCTION VIDEOTAPE
  An instructional videotape in VHS format assists nursing personnel and other medical professionals in learning procedures for operating the FLEXIFLO Quantum Enteral Delivery System. This videotape is available for your use through a Ross Representative.

FLEXIFLO QUANTUM Enteral Delivery System

PUMPS

50596	Enteral Pump—Purchase
50598	Enteral Pump—Lease/Rent

PUMP SETS

50600	Pump Set w/Piercing Pin
50602	Pump Set w/40mm Screw Cap
50604	Pump Set w/Piercing Pin With Flush Bag

CONTAINERS WITH PREATTACHED PUMP SETS

50608	1000 mL Top-Fill Bag w/Pump Set
50610	1000 mL Toptainer® w/Pump Set
50606	1000 mL Top-Fill Bag w/Pump Set With Flush Bag
50614	1000 mL Toptainer w/Pump Set With Flush Bag

All Quantum pump sets and containers with preattached pump sets can be used in the gravity mode of feeding.

SPECIFICATIONS

Power

Voltage:	100 to 130 VAC, 47-63 Hz, 1 Phase
Power:	4 watts (average)
Fuse:	½ AMP, SB type
Line Cord:	Hospital-grade, nondetachable (10 feet)
Leakage:	Less than 100 microamps

Mechanical

Height:	8.25 inches
Width:	7.5 inches
Depth:	6.0 inches (8.0 inches with pole clamp)
Weight:	7.2 lbs

Operational Specifications—Flow Rates

Range:	1-300 mL/hr
Increments:	1 mL/hr
Accuracy:	± 10% (refer to CHECKING PUMP ACCURACY, page 13).
Pressure:	Pumps against 15 psi (mean) back pressure before occlusion alarm.

Battery Operation

Type:	2.1 Ah rechargeable sealed lead acid
Voltage:	8V; the pump will fully recharge in a maximum of 8 hours if turned off, or a maximum of 12 hours if running.
Expected Life:	When fully charged, 8 hours at 125 mL/hr.

Standards

Designed and manufactured to meet requirements of UL 544 (1976).

LIMITED WARRANTY PLAN

Ross warrants the Flexiflo® Quantum™ Enteral Pump against defects in material and workmanship for a one (1) year period from date of delivery. This warranty is valid only to the original purchaser and does not extend to any product, or part thereof, which has been subjected to accident, alteration, damage, misuse, repair by other than Ross authorized representatives, or has not been operated and maintained in the manner prescribed in the Operating Manual or which at the time of pump failure was being used with pump sets or containers other than Ross pump sets and containers. Examples of damage or misuse include, but are not limited to, pumps that have been dropped, have had fluid spilled into or onto the casing or have been submerged.

In no event shall Ross be liable for any incidental, indirect or consequential damages in conjunction with the purchase or use of the pump.

Ross reserves the right to repair or replace (at its option) any pump that fails to meet the foregoing warranty.

THE WARRANTIES HEREUNDER ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE.

NOTE:
When repairs on the unit are made under warranty because of faulty material or workmanship within one year from the date of delivery to the customer, the customer will not be billed for parts repaired or replaced. Also, the customer will not be charged for labor involved in connection with the installation of such parts furnished under warranty.

Shipping costs for units returned to Ross, including loaners, shall be paid by the customer. Ross Authorization Forms should be completed and accompany the returned unit.